BC hydro

Application for an
Energy Project Certificate
Under Section 18 of the
Utilities Commission Act

Kelly Lake to Cheekye Substation Second 500 kV Transmission Line

12 July 1991

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B.C. HYDRO

KELLY LAKE

TO

CHEEKYE SUBSTATION

SECOND 500 kV TRANSMISSION LINE

APPLICATION FOR AN ENERGY PROJECT CERTIFICATE

UNDER SECTION 18 OF THE UTILITIES COMMISSION ACT

12 July 1991

This is Exhibit "A" referred to
in the affidavit of JEFFREY BARKER
Sworn to before me at the City of
Vancouver in the Province of
British Columbia on the 15th
day of July 1991

A Commissioner for Taking Affidavits
for British Columbia

AFFIDAVIT

IN THE MATTER of the Utilities Commission Act and the Regulations made thereunder;

AND IN THE MATTER of an application by the British Columbia Hydro and Power Authority for an Energy Project Certificate pursuant to Part 2, Section 18 of the Utilities Commission Act and B.C. Regulation 388/80.

I, JEFFREY BARKER, Civil Engineer, of the 10th Floor, 970 Burrard Street, Vancouver, British Columbia, make oath and say that:

1. I am a Project Manager, Project Management Division, British Columbia Hydro and Power Authority (B.C. Hydro) and as such I am authorized to make this Affidavit and sign, on behalf of B.C. Hydro, the Application under Section 18 of the Utilities Commission Act. The Application in connection with the Kelly Lake to Cheekye Substation Second 500 kV Transmission Line is dated 12 July 1991 and a true copy is attached and marked Exhibit "A" to this my Affidavit.

2. The facts contained in the Application, are to the best of my knowledge and belief, true and accurate in all respects.

SWORN BEFORE ME at the City of Vancouver, in the Province of British Columbia, this 15th day of July 1991.

W.H. McQUEEN
A Commissioner for taking Affidavits for the Province of British Columbia

JEFFREY BARKER

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KELLY LAKE TO CHEEKYE SECOND 500 kV TRANSMISSION LINE
EXECUTIVE SUMMARY

B.C. Hydro submits this Application, pursuant to Section 18 of the Utilities Commission Act, for an Energy Project Certificate for the construction of the Kelly Lake to Cheekye Substation Second 500 kV Transmission Line Project. The anticipated in-service requirement for the project is late 1996.

The Kelly Lake to Cheekye Second 500 kV Transmission Line Project consists of constructing a single circuit 500 kV transmission line, circuit 5L46, from the existing Kelly Lake Substation, near Clinton, to the existing Cheekye Substation, near Squamish, complete with substation facilities required at Kelly Lake and Cheekye and at an intermediate series capacitor station adjacent to the existing Creekside series capacitor station. De-energization and removal of all or part of existing Circuit 2L1, together with the installation of station and transmission facilities required at the existing Rainbow Substation at Whistler are also part of this project.

B.C. Hydro's mission is to support the development of British Columbia through the efficient supply of electricity. This transmission implies a responsibility to supply reliable electric service to its customers. This transmission line is needed to meet the increased domestic demand for electricity in the Lower Mainland and Vancouver Island and to maintain system reliability, efficiency and operating and planning flexibility.

After almost two years of detailed environmental and technical studies as well as a comprehensive public consultation program, a "generally-favoured" route for the transmission line has emerged. This route is technically and environmentally superior, and it appears to be favoured by most of the individuals and groups involved in the public consultation process. For the most part, this "generally-favoured" route follows the existing transmission line corridor from Kelly Lake to Cheekye. In so doing, it traverses a number of native Indian Reserves. Discussions with the native Bands are underway and some progress has been made in negotiating the routing of the proposed line through these Reserves. However, the point has not yet been reached with the Bands where agreements are in place to route the line through the Reserves. Transmission line routes which bypass these Reserves have been investigated and form the basis for the proposed route in this Application. However, it is hoped that agreements can be reached with those Bands in time for the line to be built along the "generally favoured" route. Therefore, these routes through the Reseves are also included as alternatives in this Application.

There are three existing transmission lines through the Municipality of Whistler. One of these will be removed. Its right-of-way will be utilized by the proposed transmission line where appropriate (in some cases the proposed line will deviate from the existing right-of-way to improve the visual landscape). This is the proposed route in this Application. An alternative route (the Soo-Rainbow route), which bypasses the Municipality of Whistler, is also included in this Application.

Additional specific routing studies are underway and the results of these studies will be forwarded when available, and as appropriate, as will reporting on native consultation. Consultation with government agencies, property owners and interested individuals and groups is ongoing.

This Energy Project Certificate Application has been prepared and arranged in accordance with B.C. Regulation 388/80 and is presented in sections as follows:

A - Applicant
B - Project Description and Impacts
C - Project Justification
D - Ancillary Applications
E - Public Consultation Program

This Application presents information from a number of supporting documents. These documents provide project justification as well as details of the environmental and technical aspects of the route selection process and the public consultation program.

Accompanying this Application are the following supporting documents:

1. Kelly Lake to Cheekye Substation Second 500 kV Transmission Line, Project Justification, B.C. Hydro, March 1991.

2. Kelly Lake to Cheekye Substation Second 500 kV Transmission Line, Technical Report, B.C. Hydro, March 1991.

3. Kelly Lake to Cheekye Substation Second 500 kV Transmission Line, Environmental Impact Assessment Report, Volume One, Analysis, B.C. Hydro, March 1991.

4. Kelly Lake to Cheekye Substation Second 500 kV Transmission Line, Environmental Impact Assessment Report, Volume Two, Atlas, B.C. Hydro, March 1991.

5. Kelly Lake to Cheekye Substation Second 500 kV Transmission Line, Public Consultation Report Phases 1 & 2, Synergistics Consulting Ltd., April 1991 (complete with Appendices - Volume 1 and Appendices - Volume 2).

6. Kelly Lake to Cheekye Substation Second 500 kV Transmission Line, Public Consultation Report Phases 1 & 2, Addendum, Phase 3, Synergistics Consulting Ltd., April 1991.

The following reports will be submitted at a later date:

1. Kelly Lake to Cheekye Substation Second 500 kV Transmission Line, Consultation with Native Bands, B.C. Hydro.

2. Kelly Lake to Cheekye Substation Second 500 kV Transmission Line, Response Document and Summary of Commitments, B.C. Hydro.

These supporting documents are also listed in the References section at the back of this Application.

TRANSMISSION LINES REFERENCED

B.C. HYDRO CIRCUIT NUMBER	DESCRIPTION OF TRANSMISSION LINE
2L1	Existing 230 kV transmission line, Bridge River Terminal to Cheekye Substation (self-supporting structures, three single conductors). Structures are steel except for a short length of wood pole structures west of Alta Lake.
2L2	Existing 230 kV transmission line, Bridge River Terminal to Cheekye Substation (self-supporting steel structures, three double bundle conductors).
2L90 & 2L91	Existing 230 kV transmission lines, Bridge River Terminal to Kelly Lake Substation (wood pole structures, three single conductors).
3L2	Existing 360 kV transmission line, Bridge River Terminal to Rosedale Substation via Lillooet and Harrison Lakes (self-supporting steel structures, three double bundle conductors).
5L41	Existing 500 kV transmission line, Kelly Lake Substation to Ingledow Substation (guyed and self-supporting steel structures, three quadruple bundle conductors).
5L42	Existing 500 kV transmission line, Kelly Lake Substation to Cheekye Substation (guyed and self-supporting steel structures, three quadruple bundle conductors).
5L46	Proposed 500 kV transmission line, Kelly Lake Substation to Cheekye Substation (guyed and self-supporting steel structures, three quadruple bundle conductors).

SECTION A - APPLICANT

A.1 NAME, ADDRESS AND NATURE OF BUSINESS

British Columbia Hydro and Power Authority (B.C. Hydro) is a Crown Corporation established in 1962 under the British Columbia Hydro and Power Authority Act (as it was then). It has a head office at 970 Burrard Street, Vancouver, British Columbia, Canada, V6Z 1Y3. The principal business of B.C. Hydro is the generation, transmission and distribution of electricity.

A.2 FINANCIAL AND TECHNICAL CAPACITY OF THE APPLICANT

A.2.1 Financial Capacity

B.C. Hydro is an agent of Her Majesty the Queen in right of the Province. The Minister of Finance and Corporate Relations is the fiscal agent of B.C. Hydro and B.C. Hydro may borrow money only with the approval of the Lieutenant Governor in Council and then only up to amounts authorized by the Legislature.

B.C. Hydro has constructed some of the largest projects in the province undertaken by a single corporation and has had the financial capacity to undertake them by means of borrowing guaranteed by the Province, of borrowing directly from the Province, and by funds internally generated from the operation of its business. The credit ratings on B.C. Hydro bonds from the two major financial rating agencies in the United States, Moody's Investors Service and Standard & Poor's Corporation, are Aa1 and AA+, respectively. The ratings from the Canadian and Dominion Bond Rating Services in Canada are at AA+ and AA, respectively.

A.2.2 Technical Capacity

B.C. Hydro has been responsible for the planning, design and construction of generation and transmission facilities since 1962. Consultants with special expertise in engineering, environmental and public consultation matters are retained by B.C. Hydro from time to time to advise on various aspects of projects as required.

B.C. Hydro is one of the leaders in North America for the planning, design and construction of high voltage transmission lines. At present, the 5300 km of 500 kV lines operating in the B.C. Hydro system form a major transmission grid which includes interconnections with the northwest United States and Alberta. Furthermore, there are more than 3,900 km of 360, 287 and 230 kV lines operating in the system.

The major projects described below demonstrate B.C. Hydro's capability to construct and operate 500 kV high voltage transmission systems:

(a) Peace Transmission System

A 500 kV transmission system was designed and constructed in the 1960s and 1970s from the Peace River generating stations to the major load centre in the Lower Mainland. The system includes three 500 kV lines between the Peace River and Prince George and two 500 kV lines between Prince George and the Lower Mainland. The Peace transmission system contains approximately 2100 km of 500 kV transmission lines.

(b) Columbia Transmission System

A 500 kV transmission system was designed and constructed in the 1970s and 1980s from the Columbia River generating stations to the major load centre in the Lower Mainland. The system includes two 500 kV lines between the Mica generating station and Nicola Substation near Merritt, two lines between the Revelstoke Generating Station and Nicola Substation and two lines between Nicola Substation and the Lower Mainland. The Columbia transmission system contains approximately 1500 km of 500 kV transmission line.

(c) Lower Mainland to Vancouver Island Intertie

Between 1981 and 1986, 500 kV overhead transmission lines and submarine cable interties were built between the Lower Mainland (Cheekye Substation near Squamish) and Vancouver Island (Dunsmuir Substation near Qualicum) - a distance of approximately

148 km. The installation of the 500 kV state-of-the-art submarine cable, the only one of its kind in the world, was a major engineering accomplishment.

(d) Other 500 kV Transmission Lines

Various other major 500 kV transmission lines have been designed and constructed including: the Cranbrook to Alberta Border intertie (108 km completed in 1985), the Ingledow to U.S. Border intertie (two 36 km lines completed in 1968 and 1973), the Kelly Lake to Nicola line (146 km completed in 1984), the Selkirk to Nicola line (302 km completed in 1981), the Selkirk to Ashton Creek line (223 km completed in 1979), the Selkirk to Cranbrook line (180 km completed in 1981) and the Williston to Skeena line (449 km completed in 1978).

(e) Substations

B.C. Hydro has designed and constructed twenty-five 500 kV stations that are associated with the 500 kV transmission lines described above, as well as numerous 230 kV stations. More recently, the Kennedy 500 kV Substation was designed and built near Mackenzie and a new 500 kV series capacitor station was built at American Creek near Yale.

A.3 NAME, TITLE AND ADDRESS OF PERSONS TO CONTACT WITH RESPECT TO THIS APPLICATION

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SECTION B - PROJECT DESCRIPTION AND IMPACTS

B.1 DESCRIPTION OF THE PROJECT, ITS PURPOSE AND COST

B.1.1 Introduction

The Kelly Lake to Cheekye Second 500 kV Transmission Line Project consists of constructing a single circuit 500 kV transmission line, circuit 5L46, from the existing Kelly Lake Substation, near Clinton, to the existing Cheekye Substation, near Squamish, complete with substation facilities required at Kelly Lake and Cheekye and an intermediate series capacitor station to be located adjacent to the existing Creekside series capacitor station. De-energization and removal of all or part of existing Circuit 2L1, together with the installation of station and transmission facilities required at the existing Rainbow Substation at Whistler are also part of this project.

This sub-section provides information on the technical details of the project, the proposed and alternative routes, the project purpose and the project cost.

B.1.2 Technical Details

B.1.2.1 Towers

Two tower configurations are proposed for 5L46 as described below:

(a) Delta Configuration - This is a single circuit lattice steel tower with the three electrical phases (conductors), arranged in a delta or triangular configuration. It includes both guyed and self-supporting styles. This configuration is new to B.C. Hydro. An average height for both styles is approximately 45 m. See Figure 5(a) which illustrates typical outlines for both guyed and self-supporting delta configuration towers.

(b) Conventional (or flat) Configuration - This configuration has been used for the existing 500 kV transmission lines throughout the B.C. Hydro system. The configuration

- consists of a single circuit lattice steel tower supporting three electrical phases (conductors), in a horizontal (or flat) configuration. It includes both guyed and self-supporting styles. An average height for both styles is approximately 35 m. See Figure 5(b) which illustrates typical outlines for both guyed and self-supporting flat configuration towers.

B.C. Hydro will use the delta configuration tower with insulator strings in the form of a "V" for most locations on 5L46 because it offers certain advantages over the conventional flat conductor configuration. These advantages include:

- A more compact line design, which results in reduced right-of-way and clearing requirements.

- Higher power transfer capability

- Lower EMF (electric and magnetic field) values. Compared to the conventional flat configuration, the reductions in the average values of magnetic and electric fields occurring at the edge of the new narrower right-of-way are 30% and 20% respectively.

The delta tower will not be used exclusively for 5L46. High ice and wind loadings on the conductors resulting from the elevation and climatic exposure of some areas along the route warrant a heavier tower design than that proposed for the new delta towers. In these areas, an existing flat configuration design will be used. Also, in some areas, the additional height of the delta tower may be perceived as less desirable than the shorter flat configuration towers. In these areas, conventional (or flat) configuration towers are proposed.

For both configurations, guyed towers will be used where terrain conditions permit, where routing is straight and at small deflection angles (bends or corners in the line). Guyed towers are estimated to account for approximately 60% of the towers. Self-supporting towers will be used for larger deflection angles, at line terminations, in heavy snow areas, to suit certain terrain conditions, (e.g. steep slopes or swamps), and generally where ice and wind

loadings warrant stronger heavier towers. Span length, or distance between towers, for both configuration varies depending on terrain, However, spans of 300-500 m are typical.

B.1.2.2 Conductor

Studies were carried out to determine the optimum conductor for use on this project. The studies considered factors such as:

- maintenance and operating costs
- estimated electrical loads to be carried by the proposed transmission line
- estimated present worth of electrical losses over the life of the transmission line (a function of the resistivity of the conductor and the cost of the electrical energy)
- estimated present worth of the cost of the transmission line including material and construction costs

5L46 uses 469.5 mm^2 area (926.7 MCM), ACSR conductor installed in a bundle of four on each of the three phases. It has an outside diameter of 29.16 mm. This is slightly larger than the typical conductors of the existing 500 kV lines in the study area which have an outside diameter of 24.13 mm. The use of "dulled" conductor, or conductor with a lower reflectivity, is under investigation and may be proposed for visual reasons in certain areas.

The conductor to ground clearance varies depending on the terrain, ambient air temperature, and electrical loading. The typical value for the minimum conductor to ground clearance (under maximum sag conditions) is 9.6 metres. This will be increased where 5L46 crosses roads, railways, pipelines, or other transmission or distribution lines. B.C. Hydro's designs for transmission lines, including conductor to ground clearances, meet or exceed Canadian Standards Association (CSA) recommendations.

B.1.2.3 Access

Access for the transmission line construction is normally by roads, the standards for which depend on the extent of the area served by a given road, the nature of the equipment which must use the road,

land ownership, and any ongoing needs for line and right-of-way maintenance and environmental sensitivity. Where road access is deemed inappropriate, access will include the use of helicopters.

A preliminary access assessment will be prepared for the proposed and alternate routes. The assessment identifies any existing roads that may be used in the construction and maintenance of the new line. It also makes recommendations where the possible construction of new roads may be required.

Once centreline survey and tower layout is completed, detailed access assessment plans will be prepared for the project. This will provide further detail on the location and standards of the roads to be used for clearing and construction. These access plans will take into account such items as:

- type and location of towers
- construction methods
- ownership of land, crown or private
- presence of merchantable timber
- environmental considerations
- public input

Access development is an ongoing activity through the clearing and construction phases of the project.

B.1.2.4 Right-of-Way Requirements

Right-of-way requirements should be distinguished from clearing requirements. For the proposed route (and the alternative routes), the requirements for additional right-of-way will vary from nil (where it utilizes existing right-of-way), to the acquisition of a full new right-of-way.

Right-of-way widths are based on guidelines recommended by the Canadian Standards Association (CSA) electrical code requirements. These include the physical geometry of the transmission line, in particular:

- horizontal conductor spacing, i.e. distance from centreline to the outside conductor

- conductor weight and size (this determines the degree to which the conductor swings under the wind and temperature conditions specified by CSA)
- conductor sag, determined by conductor tension and weight, and span length
- the physical geometry and conductor sag characteristics of adjacent transmission lines (if any) and the separation required between the lines

The standard distances from adjacent lines and the subsequent required additional right-of-way will not be established until the route is selected. However, Figure 6 provides preliminary detail of the additional right-of-way requirements for a delta configuration tower adjacent to the flat configuration of existing 5L42.

Non-standard distances between transmission lines and additional right-of-way requirements occur along the route. Examples include long spans where separation must be increased to allow for greater conductor swing, or where terrain constraints do not permit 5L46 to be placed exactly parallel to other lines.

B.1.3 Proposed and Alternative Routes

B.1.3.1 General (refer to Figures 1-4)

A "generally favoured" route for the Kelly Lake-Cheekye 500 kV transmission line has emerged after almost two years of detailed environmental and technical studies of routing alternatives, together with a concurrent and comprehensive program of public consultation. This route appears to be the best from an overall environmental and technical perspective. In addition, it appears to be supported by most of the individuals and groups involved in the public consultation process.

For the most part, this "generally favoured" route follows the existing transmission line corridor from the Kelly Lake Substation to the Cheekye Substation. In so doing it traverses a number of native Indian Reserves. Indian Reserves are parcels of land held in the name of the federal Crown on behalf of the respective native Bands. Regulatory approval for the construction of a transmission line across Indian Reserves is not feasible without the agreement

of the Bands and the federal government. Discussions have been underway for some time with the various Bands and some progress has been made on negotiating or resolving transmission line routing which affects the Reserves. However, the point has not yet been reached with the Bands where agreements are in place to route the line through their respective Reserves. Alternatives to bypass these Reserves have been investigated. The Reserves (and native Bands) where agreements are not yet in place are:

- Pavilion IR1 (Pavilion Indian Band)
- Bridge River IR1 (Bridge River Indian Band)
- Seton Lake IR5A (Seton Lake Indian Band)
- Nequatque IR1 (Anderson Lake Band)

Therefore, the proposed route in this Application is the "generally favoured" route except for the four native Reserves noted above. Routes which bypass the Pavilion IR1, Bridge River IR1, Seton Lake IR5A and Nequatque IR1 are proposed as the basis of this Application. However, since it is hoped that agreements can be reached with the respective Bands in time for the line to be built along the "generally favoured" route, alternative routes through the Pavilion IR1, Bridge River IR1, Seton Lake IR5A and Nequatque IR1 are also included in this Application. These agreements must be in place by January 1992 to permit the line to be in-service by late 1996. Alternative routes through the Lokla IR4 (Mount Currie Indian Band) and the Cheakamus IR11 (Squamish Indian Band) are not included since this "generally favoured" route bypasses these two Indian Reserves.

There are three route options in the vicinity of the Municipality of Whistler:

1. the removal of existing transmission line circuit 2L1 through the Municipality of Whistler and the use of its right-of-way for the new Kelly Lake-Cheekye line;

2. as above, except that the new Kelly Lake-Cheekye line will deviate from the 2L1 right-of-way in some areas to improve the visual landscape. This option is the proposed route in this Application;

3. the Soo-Rainbow route to the west which bypasses the developed portion of the Municipality of Whistler. This route option is included as an alternative route in this Application.

The proposed route through the Municipality of Whistler reflects the results of environmental and technical studies. Consultation with the Municipality of Whistler and the public has not provided a clear indication of the preference on routing amongst the options presented, although recent advice from municipal officials noted a preference for the proposed route described above over the Soo-Rainbow route. A Municipality of Whistler Council resolution in March 1990 noted the following five items to be addressed by B.C. Hydro with respect to the Kelly Lake-Cheekye project and its routing through the Municipality:

"1. That B.C. Hydro and Power Authority review and apply practices in other areas such as Washington and Colorado and identify other possible alternate design of towers which are painted, to identify routings which are more sensitive to visible considerations, and alternate right-of-ways which are narrower and contain significantly more vegetation.

2. Relocate two, and possibly three, hydro corridors away from Green Lake.

3. Relocate the two hydro corridors to the west of Alta Lake Road above the bench to adjacent the existing hydro corridor.

4. Relocate two hydro corridors which depart to the west at Function Junction to join the hydro corridor to the east. This will move two hydro lines away from Highway 99 from Function Junction to Brandywine to a less visible location.

5. Relocate underground, all overhead wiring adjacent Highway 99 from Bayshores to Emerald Estates."

Planning activities and mitigation measures directly associated with the proposed Kelly Lake-Cheekye 500 kV transmission line project have addressed Item 1 and parts of Items 2 and 4, as follows:

1. The reduction of visual impact is an ongoing commitment. New structures are being designed and tested. These structures are narrower than conventional ones and require less right-of-way and less clearing of trees. Conductors which are "duller" than normal will be proposed, pending results of discussions with Transport Canada from an aviation safety point of view.

2. One existing transmission line will be removed from the shore of Green Lake.

3. One existing transmission line will be removed from proximity to Highway 99 from Function Junction to Brandywine.

The remaining items (or parts thereof) are unrelated to the proposed project. The estimated costs to address these remaining items are in the order of $10 to $20 million. Through meetings and correspondence over the past year or so, the Municipality has been advised that:

1. The proposed routing provides the opportunity to improve the present situation by removing an existing line from sensitive locations.

2. Mitigation for project related impacts has been included in the proposed route described in our Energy Project Certificate Application.

3. Under the present regulatory guidelines, B.C. Hydro is not in a position to negotiate or compensate individuals or communities for non-project related items.

4. A thorough review of the Application is anticipated. The Municipality is urged to take part in the review of the Application, and to put forward their position that between

$10 and $20 million worth of compensation should be included in this project.

5. B.C. Hydro cannot support the Municipality beyond the items already embodied in the project mitigation.

At its 8 July 1991 meeting, the Municipality of Whistler Council rescinded the March 1990 Council resolution which listed the five items to be addressed by B.C. Hydro. The Council further decided to retain a consultant to advise them, and to confer with their neighbouring municipalities.

With respect to routing across the Lillooet River Valley in the vicinity of the Village of Pemberton, environmental and technical studies had indicated that a proposed routing adjacent to the existing 500 kV line across the valley appeared to be the best solution. This routing is described in this Application. However, recent discussions with residents have resulted in further routing studies, the results of which will be submitted when they are available, along with public response to these studies.

The proposed and alternative routes are shown on Figures 1-4 included with this Application and are briefly described below (detailed technical and environmental analysis of the routes can be found in the separate technical and environmental reports). The capital letters refer to node points which are indicated on Figures 1-4.

B.1.3.2 Proposed Route

The route exits the south side of Kelly Lake Substation (A) and follows the east side of existing 500 kV lines 5L41 and 5L42 for approximately 15 km (existing 230 kV wood pole lines 2L90 and 2L91 are situated between 5L41 and 5L42 from approximately km 6 of this section). For this portion, the route is within existing unoccupied right-of-way.

Immediately north of the Pavilion Indian Reserve (W), the route leaves the existing right-of-way and crosses Pavilion Creek and Highway 12 north of the Pavilion village. The route then traverses the bench to the south-east of the reserve before descending and

crossing existing circuits 5L41, 2L90, and 2L91. Highway 12 would also be crossed again (D). The route then crosses the Fraser River (approximately 1.5 km south of the existing 5L42 crossing), and rejoins the existing alignment of 5L42 (E).

The route continues adjacent and parallel to existing circuit 5L42 for approximately two kilometres. From here (F1), the route leaves the 5L42 alignment and ascends the Camelsfoot Range via the upper portion of Lee Creek. It then descends into Bridge River valley, crossing Applespring Creek, and continues north-west to Antoine Creek at the western boundary of the Bridge River Indian Reserve (X). Here the route crosses the Bridge River and gradually ascends the north side of Mission Ridge. At the summit of Mission Ridge (G), the route rejoins 5L42. After reaching a summit at an elevation of approximately 1900 metres, the route descends the south side of Mission Ridge. The route deviates from the existing 500 kV line (G1) for approximately five kilometres to by-pass the Seton Indian Reserve.

B.C. Hydro's Bridge River Generating Station is located near Shalalth, on the south side of Mission Ridge. From here, four transmission lines presently run south. They are:

- Circuit 5L42 to Cheekye Substation
- Circuit 3L2 to Rosedale Substation, (near the east side of Chilliwack)
- Circuit 2L2 to Cheekye Substation
- Circuit 2L1 to Cheekye Substation

2L1 is the oldest of the three lines running from the Bridge River Generating Station. It has been in service since 1948. It is proposed that 2L1 be removed and the route use its 61-metre right-of-way where practicable. Approximately 37 km (27%) of 2L1 right-of-way is proposed for use by 5L46.

From Shalalth, or Seton Portage, through to D'Arcy, the route is on the west side of Anderson Lake, on the 2L1 right-of-way. 2L1 is the lowest (and closest to the shoreline) of the four lines located along Anderson Lake (Section G2-H1-H).

At D'Arcy the route is between 2L2 and 5L42. Detailed technical studies are required to confirm the feasibility of this location. If technical difficulties preclude this location, then either 2L2 or 5L42 could be dismantled and double circuit towers installed. Continuing south through the Birken area, the route leaves the existing lines on the valley floor and goes high on the south side of the valley (H2). It then descends and continues parallel to 5L42 above the south shore of Gates Lake. The route continues parallel to 5L42 until the Creekside Capacitor Station just north of Pemberton (J). The route bypasses the Lokla Indian Reserve.

Circuit 5L42 is connected to Creekside Capacitor Station. 5L46 would also connect to this station. It is necessary to enlarge the station to accommodate capacitors for 5L46. This expansion approximately doubles the size of the built portion of the site but is within the limits of the existing property owned by B.C. Hydro.

From Creekside Capacitor Station to the north side of the Lillooet River valley, the route is on the 2L1 right-of-way. In this area close to Mosquito Lake, this right-of-way is between 5L42 and 2L2.

Across the Lillooet River valley at Pemberton, the route leaves the 2L1 right-of-way in favour of running parallel to 5L42 farther from the town centre. The route continues parallel to 5L42 over Signal Hill on the south side of the valley. However, as noted earlier, further route studies are underway, the results of which will be forwarded when available.

Near Nairn Falls Provincial Park (K), the route leaves the 5L42 alignment. The route stays high on the south side of the valley until just south of the Tisdall area where it rejoins the 5L42 alignment. From approximately 7 km east of Green Lake, the route follows the 2L1 right-of-way to the eastern end of Green Lake.

At Green Lake, the three lines are south of and beside the lake. Two of these lines, 2L1 and 2L2, are situated low, close to the shoreline. 2L1 will be removed, and the route is located higher, adjacent to 5L42.

Between Green and Alta Lakes, through the River of Golden Dreams area, the route is on the 2L1 right-of-way between 5L42 and 2L2.

On the west side of Alta Lake, 2L1 is located on a bench above 2L2 and 5L42. The route follows this alignment for a short distance (2 km), before it deviates to where it is better screened from view. The route then returns to the 2L1 right-of-way through Function Junction at the south end of Whistler.

From Function Junction (Y1), the route crosses Highway 99 and the gravel pit area. After crossing 5L42 (Y), the route then ascends the logged areas above the east side of Daisy Lake before it descends and crosses Rubble Creek close to B.C. Hydro's Cheakamus Dam (P1).

From Rubble Creek the route is generally north and east of 5L42 and Highway 99 until Cheekye Substation (T) thereby bypassing the Upper Cheakamus Valley, the North Vancouver Outdoor School and the Cheakamus IR11 of the Squamish Indian Band.

B.1.3.3 Alternative Routes Through Indian Reserves

The following route alternatives recognize the potential for agreement with affected native Bands on routes crossing Indian Reserves. Should agreement be achieved prior to January 1992 these generally-favoured alternative routes will be used.

(a) Pavilion IR1

Existing lines 5L41, 5L42, 2L90, and 2L91 currently cross the Pavilion Indian Reserve (Section W-C). The alternative route follows these lines for approximately 4 km before leaving them and following 5L42 across the Fraser River. The alternative route continues to follow 5L42 on the west side of the Fraser River (C-E). Based on discussions with the property owner north of the Pavilion Indian Reserve, it may be desirable to locate the new line on the west side of the existing lines through the ranch and the Pavilion IR1.

Until these discussions are concluded satisfactorily, the route is indicated on the east side of the existing transmission line (on existing ROW) on Figures 1 and 2.

(b) Bridge River IR1

Existing line 5L42 crosses the Bridge River Indian Reserve near the confluence of the Bridge River and the Fraser River (F). It is on reserve land for approximately 2.5 km. The alternative route through this reserve is adjacent and parallel to 5L42 (Section F1-G).

(c) Seton Lake IR5A

Existing line 5L42 crosses the Seton Indian Reserve above Shalalth, or Seton Portage, and is on reserve land for approximately 1.5 km. The alternative route is adjacent and parallel to 5L42 (Section G1-G2). Existing circuit 2L1 through the Reserve will be removed.

(d) Nequatque IR1

Existing lines 2L1 and 3L2 currently cross the Nequatque IR1 at D'Arcy. The alternative route through this Reserve is adjacent and parallel to 3L2. Existing circuit 2L1 will be removed.

B.1.3.4 Alternative Route to Bypass the Municipality of Whistler

The alternative route to the west of the developed portion of the Municipality of Whistler is known as the Soo-Rainbow alternative. It leaves the existing transmission line corridor in the Green River Valley north of Whistler near the junction of Rutherford Creek and the Green River, proceeds southwest over a ridge into the Soo River Valley, then turns west along the south side of the Soo River wetlands to a point high on the ridge to the north of the pass west of Rainbow Mountain. Here the route would turn south, traverse the pass and continue through the lower valley of Callaghan Creek before rejoining the proposed route.

B.1.4 Project Purpose

The purpose of the Kelly Lake-Cheekye Second 500 kV transmission line and its associated facilities at Kelly Lake, Cheekye and at an intermediate series capacitor station, is to meet the increased domestic load in the Lower Mainland and Vancouver Island, and to maintain system reliability, efficiency and operating and planning flexibility. More details can be found in Section C entitled "Project Justification".

B.1.5 Project Cost

The total estimated cost of the project, including inflation, corporate overhead and interest during construction, and utilizing the proposed route, is $247 million ($1990), made up as follows:

Project Component	Estimated Costs ($1990 Million)
Transmission Line*	135.5
Kelly Lake Substation	11.6
Cheekye Substation	2.1
Creekside Capacitor Station	8.6
Rainbow 230 kV Tap	.1
Rainbow Substation	1.5
Estimated Uninflated Cost	159.4
Inflation	36.2
Corporate Overhead	15.7
Interest during Construction	35.1
Total Estimated Project Cost	246.4
or approximately	$247 million

* includes 2L1 removal costs from the Bridge River Terminal to Cheekye Substation

If agreements with the affected native bands are reached such that the alternative routes through the Pavilion, Bridge River, Seton Lake and Nequatque Indian Reserves were subsequently chosen, this estimate would be reduced by a total of about $16 million (which includes inflation,

corporate overhead and interest during construction). This reduction would be offset by the cost of those agreements, the magnitude of which is not yet known.

The proposed route replaces existing circuit 2L1 through the Municipality of Whistler, with deviations in some areas to improve the visual landscape. Since discussions on transmission line routing and other issues are ongoing with the Municipality, the cost of bypassing the developed portion of the Municipality of Whistler (estimated at approximately $12 million, which includes inflation, corporate overhead and interest during construction) has been included in the total project estimate noted above.

B.2 TIMETABLE

The proposed in-service date for this project is the fall of 1996. The proposed schedule is outlined in Figure 7.

This schedule is extremely tight with little opportunity for further compression. Shorter than anticipated construction seasons, construction shut-downs as a result of closures due to forest fire hazard, prolonged periods of inclement weather, material and equipment shortages, or labour disputes could jeopardize the 1996 in-service date.

The schedule indicates that some engineering survey is required in the fall of 1991. This preliminary field survey work, known as "Primary Survey Control" will involve the establishment of 12 to 15 "primary control" points along the length of the line from Kelly Lake Substation to Cheekye Substation. These points will be well removed from the proposed centreline alignment of the transmission line. These points will generally be on prominent locations at high elevations on Crown land away from local communities. Tripod mounted electronic measuring survey equipment will be set up at each site. Some cutting of vegetation may be necessary to achieve a "line of sight" to at least two other control points. Where possible, points are located where cutting is not necessary. In addition to these primary control points, some survey ties to existing transmission line towers on the existing right-of-way will also be required. These will be in selected cleared locations with no cutting of vegetation anticipated.

Access to the primary control points will usually be by helicopter and will involve two or three two-man crews. The duration of this work, being weather dependent, is uncertain, but it is expected to be in the order of one to two months.

B.3 PUBLIC WORKS

There are no new public works required for this project.

B.4 IDENTIFICATION AND PRELIMINARY ASSESSMENT OF IMPACTS

B.4.1 Introduction

The proposed route and alternative routes are described in Section B.1. The following discussion of impacts deals with those of the proposed route and any alternative route.

5L46 is proposed to be constructed in a well-established corridor through the Coast Mountains. The corridor presently contains up to four transmission lines, a railway, roads and a highway. 5L46 would require a minimum of new access roads for its construction because of the existing road system and pattern of logging roads.

In 1979, construction of a double circuit 500 kV transmission line from Kelly Lake substation to Cheekye substation with an intermediate substation at Creekside was proposed.

The environmental study was issued in April 1981. The study defined a preferred corridor for the proposed transmission line, as required by the Stage I level of the "Guidelines for Linear Development" issued by the B.C. Environment and Land Use Committee (ELUC). The study concluded that the corridor containing the existing 5L42 and 2L1 transmission lines was the preferred choice. This corridor was also preferred for technical and economic reasons.

In September 1980, the B.C. Government changed the procedure for review of major energy projects, including 500 kV transmission lines, by introducing the Utilities Commission Act and its associated regulations. This superseded the "Guidelines for Linear Development" and established information requirements under the Energy Project Review Process.

In 1982, lower projections for the increase in the demand for electricity had reduced the project to a single circuit line with no intermediate substation.

Environmental and social impact studies were undertaken to determine a preferred alignment within the corridor recommended by the previous study. Since the project was deferred, a report on the results of those studies, completed in 1984, was not issued. That report, however, concluded that an acceptable route existed within the existing corridor using sections of the 2L1 ROW.

In February 1989, the project was reactivated. The scope of the environmental study was expanded to cover a larger route network than that studied in 1981 to 1984. The field studies and public consultation program were initiated in 1989 and the 1984 report was issued as an information document.

In 1990, the route network under review was further extended in response to suggestions from the public during the public consultation program and because of the uncertainty of obtaining a ROW across Indian Reserves.

Environmental impacts will be managed in the context of sustainability which will involve a commitment to natural resource maintenance and enhancement. Concerns raised during the planning and licensing process will be included in an Environmental Management Plan. Environmental inspectors will be employed during right-of-way clearing, construction and immediate post-construction phases of the project. These inspectors will ensure that the environmental commitments outlined in the Environmental Management Plan are fulfilled. They will work closely with construction and regulatory agency personnel.

B.4.2 Summary of Potential Impacts for the Proposed Route

This section summarizes potential environmental impacts of construction and operation of 5L46 on the proposed route.

B.4.2.1 Terrain

Terrain conditions for the project vary from very rugged to gentle and the climatic conditions from arid to wet. In combination, there is the potential for a wide variety of adverse terrain impacts. Areas with significant potential impacts are listed below with the proposed mitigative measures:

1. Pavilion Creek Valley (Section WW1 of East Pavilion Segment)

   If the steep south facing slope is disturbed by construction of an access road, restoration and revegetation would be very difficult. It is proposed not to use access roads on this slope. The Pavilion slide will not affect the project.

2. Fraser Canyon (Section DE of East Pavilion Segment)

   The steep slopes of the canyon are difficult to rehabilitate after disturbance due to the material and arid conditions. It is proposed not to extend access roads into the canyon and to reseed disturbed areas around each structure.

3. Bridge Segment (F1X)

   The rugged terrain traversed at high elevation in the drainage east of Applespring Creek and the steep slope descended on the east side of Applespring Creek are areas of potential high terrain impact due to existing natural processes of mass wasting and erosion. It is proposed to use helicopters for some construction activities in this section.

   The two ridges west of DL 8445 traversed by the route are very arid and potential terrain impacts are high. Some helicopter construction is proposed over the ridges.

   The traverse of the south facing slopes above the Bridge River has the potential for high terrain impacts where slopes are steep and surficial material is loose. Some helicopter construction is proposed for such parts of this traverse.

4. Anderson Lake (GH)

   Steep slopes, loose surficial material and an arid climate make rehabilitation of disturbed sites difficult. Access roads will be located and constructed with this in mind, and

disturbed areas will be recontoured and reseeded with forage grasses after tower erection is complete.

5. Gates River Valley (Eastern part Segment HJ)

The route is located over steep rock bluffs for 3 km. Terrain impacts will be minimized by using helicopters for some construction activities.

6. Whistler Wetlands (Part of Segment LY)

Piled foundations will likely be required in wetlands. Impacts will be reduced by: constructing in the fall, using temporary roads of clean gravel over a geotextile material layer, and by recovering road materials after completion.

7. Rubble Creek Valley (Part of Segment Y1Z)

Terrain impact on the steep north side of the valley from construction of an access road will be high due to the steep slopes and high rainfall. Some helicopter construction is proposed for the 1.5 km of this descent.

8. Cheakamus River Valley (Part of Segment Y1Z)

In the 19 km from the head of the Cheakamus Canyon to node Z there is a total of 5 km with high terrain impact potential from road construction, due to steep slopes, areas of instability, and mass wasting, such as screes and exposed rock faces. Some helicopter construction is proposed for these sections.

B.4.2.2 Forestry and Vegetation

There are marked changes in the vegetation along the route as it crosses the climatic transition from dry interior to wet coastal. Elevation changes bring additional variations.

The route contains 6 of the 14 biogeoclimatic zones recognized in British Columbia, located in general terms, as follows:

Bunchgrass zone	Fraser Canyon
Ponderosa pine zone	Fraser Canyon & Bridge River Valley
Interior Douglas fir zone	Pavilion Mountain, Anderson Lake, Gates & Birkenhead River Valleys
Engelmann spruce Subalpine fir zone	Mission Ridge
Montane spruce zone	Mission Ridge, Pavilion Mountain
Coastal western hemlock zone	Pemberton to Cheekye

The greatest environmental change is associated with the clearing of the ROW, especially in densely forested areas. No clearing is required for the following lengths:

Near Kelly Lake substation	0.5 km
Diamond S farmlands	2.5 km
Pavilion Creek valley	0.5 km
Fraser Canyon, east side	1.0 km
Fraser Canyon, west side	1.5 km
Ivey Lake	4.0 km
Pemberton Valley	1.0 km
Whistler wetlands	2.0 km
	13.0 km

The approximate areas in hectares requiring clearing are shown below, separated in accordance with the biogeoclimatic zones for greater clarity in identifying the impacts.

Biogeoclimatic Zone	Existing ROW uncleared (ha) (approx. 50 m clearing)	Existing ROW cleared (ha) (approx. 30 m clearing)	New ROW uncleared (ha) (approx. 70 m clearing)
Bunchgrass	--	--	25
Ponderosa Pine	--	--	38
Interior Douglas Fir	45	126	365
Engelmann Spruce Sub-alpine Fir	--	--	35
Montane Spruce	23	--	44
Coastal Western Hemlock	60	--	385

The total area of clearing (determined by adding the three categories of clearing) is estimated at 1146 ha. The final area can only be determined once a centre line is established and a clearing survey undertaken.

Forestry impacts lie in loss of productive forest land. Of the total estimated area of new clearing of 892 ha, less than 5% is estimated to be of "good" or "medium" site quality as defined by the Ministry of Forests.

On Crown lands all of the present commercial and immature timber stands on the cleared area along the ROW will be made available for salvage. Recovery of the timber on Crown land will meet the requirements of Licences to Cut issued by the Ministry of Forests. On private lands and Indian Reserves the procedures will vary with the agreement made with the owner.

The route passes through a variety of timber tenures. The impact on extensive cut based tenures is very limited, but the impact on small area based tenures, such as woodlot licences, could be high. Woodlots are crossed near D'Arcy (WL 40) near Pemberton (WL 15), and near Cheekye (WL 27). Some adjustment of the management plans for these woodlots may be necessary following the clearing for the project.

Other than the changes brought by clearing, potential impacts on vegetation include disturbance of sensitive sites, which are difficult to revegetate such as in the arid zones of the Fraser Canyon, Bridge River and Anderson Lake, the park-like alpine area on Mission Ridge, and some limited sites in other parts. Of these the most significant is the park-like area of Ponderosa pine in the Bridge River Valley. Here the clearing will take place in an area that is considered to have regional interest in the aesthetic appeal of the forest.

B.4.2.3 Agriculture and Grazing

The following lands with agricultural or grazing potential are crossed.

	Agriculture	Grazing
Kelly Creek Valley	1 km (ALR, Class 3 & 4)	-
Pavilion Mountain	-	6 km
Diamond S Ranch	7 km (ALR, Class 2 & 3)	-
Pavilion Creek valley	0.5 km (ALR, Class 2 & 3)	0.5 km
Mount Cole	-	4.5 km
Fraser bench (east)	1 km (ALR, Class 2 & 3)	0.5 km
Fraser bench (west)	1.5 km (ALR, Class 3 & 4)	0.7 km
Camelsfoot	-	4 km
Pemberton Valley	2 km (ALR, Class 2 & 3)	-

The potential adverse impacts on agricultural lands are soil compaction, crop loss, loss of arable land and conflict with cultivation or irrigation. Mitigation measures will include construction after crop removal when the land is dry, and consultation with land owners on tower location to minimize interference with farming activity.

The land in the Kelly Creek valley is used for pasture and impacts would be minor.

On the Diamond S Ranch B.C. Hydro already has an unused ROW on the east side of the existing lines. However, it may be desirable to locate the line on the west side of the existing lines at the request of the owner. Further discussion with the owner will take place to confirm this location and in order to minimize impacts on irrigation systems.

The land in the Pavilion Creek valley will be spanned, presenting very low impact.

It is anticipated that the line can be located across the irrigated benchlands on the east side of the Fraser in such a way that no towers will be on the irrigated land, and impacts will be negligible.

On the west side of the Fraser the route crosses a wide bench with the potential for irrigation. The owner will be consulted on location of towers to minimize impact on any irrigation system.

In grazing areas the reseeding of the ROW with forage grasses will enhance the grazing capability.

B.4.2.4 Wildlife

The major wildlife species having recreation and economic interest found in the study areas include deer, mountain goat, black bear, California bighorn sheep and three species of grouse. Other species found less often include moose, grizzly bear, cougar and a variety of waterfowl. No endangered species or their habitat have been identified along the route. The habitats of greatest wildlife interest along the route and the potential impacts on them have been identified as follows:

Area	Habitat	Potential Adverse Impacts
Pavilion	Spring and summer range for deer	Disturbance, loss of shelter
Fraser Canyon	Winter range for bighorn sheep	Disturbance, increased hunting pressure if access roads extended
Camelsfoot Range	Year round range for deer and black bear	Disturbance, increased hunting pressure if access roads extended
Bridge River Valley	Important high capability winter and summer deer range	Disturbance, degradation of range due to roads and clearing, increased hunting pressure if roads extended
Bridge River Canyon	Mountain goat range	Disturbance, increased hunting pressure due to improved access
Anderson Lake	Year round range for for deer	Disturbance, loss of shelter strips between ROW from increased clearing
Pemberton	High capability deer range on lower slope north of valley	Disturbance
Whistler	Wetlands	Disturbance of hydrology of wetlands, disturbance of wildlife
Brohm Lake	Good year round deer range	Disturbance

A potential positive impact will be an increase in browse for ungulates on the ROW and in "edge effect" on the ROW where vegetation becomes more diverse.

There is hunting of wildlife by native and non-native hunters in the Camelsfoot Range and Bridge River Valley, along Anderson Lake

and in the lower Birkenhead River Valley. Hunting pressure in the Camelsfoot Range and Bridge River Valley will be increased by extension of the existing road system.

Management of these potential impacts will include:

1. Vegetation management practices on Crown land during right-of-way clearing and maintenance to encourage low growing vegetation of value to wildlife.

2. Hand-clearing in riparian, wetland and alpine habitats.

3. Strict control of all access road development to minimize changes to hunting patterns, especially in the Fraser Canyon and Bridge River valley.

4. Use of construction methods in Whistler wetlands that will not adversely affect wetland hydrology. Access roads, foundations and towers will be constructed in dormant season.

B.4.2.5 Heritage

The route traverses lands within the influence of two native ethnolinguistic groups, the Lillooet and Squamish peoples, and is within a corridor important in the early stages of non-Native settlement. There is thus a relatively rich endowment of heritage sites, particularly in the northern part of the route.

Fifteen sites of moderate to very high heritage values were identified along the route. Of these, four were estimated to be within the proposed ROW and 11 near enough to be possibly affected by 5L46 activities.

The most important sites, identified by Borden designation or lot number, are:

Kelly Creek	-	Campsite (EgRk9) & historic homestead (EgRk10)
Gillon Creek	-	Village site, lithic scatters (EfRk33, EfRk35), cultural depressions (EfRk32)
Pavilion Creek	-	Historic homestead (EfRl22)
Bridge River	-	Area of high potential (DL3222)
Anderson Lake	-	Historic home (DL4802)

Management of heritage sites will include:

1. Location of all sites prior to clearing or construction and marking boundaries of all those likely to be affected by the line or access roads.

2. Avoidance of sites by roads and structures where possible.

3. Clearing by hand of all trees on sites within the clearing area for 5L46.

4. Investigation of all sites by a qualified archaeologist where disturbance is unavoidable.

5. Use of protective measures, such as earth cover, where necessary.

6. Compliance with requirements of Heritage Conservation Act.

B.4.2.6 Fisheries

The major potential impacts on fish from construction and maintenance of a transmission line are a deterioration in water quality, usually from erosion, or creation of a migration barrier. B.C. Hydro has recognized these for many years and has adopted standards for clearing and access road construction to minimize the risk.

The major rivers crossed are the Fraser, Bridge and Lillooet. However, the transmission line crossings will be designed so that there will be no adverse impact on fish.

The route crosses several smaller rivers that support salmonids including Whitecap Creek, Blackwater River, Gates Creek, Birkenhead River, Green River, Cheakamus River and Cheekye River. No road crossings of these rivers will be required for these except for the Birkenhead and Green Rivers. These will be so located as not to create adverse impacts for fish.

Numerous tributary streams support populations of trout and other resident species and will require to be crossed by the proposed route, and in some cases, a new access road. Standard clearing practices and appropriate designs of any such crossings will result in low impact.

The route requires new clearing for extensive lengths within the valleys of Gates Creek, Birkenhead River, Green River, and Cheakamus River. These are the sections where the potential for erosion and adverse impact is greatest. The clearing program will be designed to minimize erosion. Use of hand clearing adjacent to tributary streams will also reduce the risk of siltation.

Important native fishing sites exist near the proposed route on the Fraser River, at the junction of the Fraser and Bridge Rivers, on Portage Creek, at Lokla on the Birkenhead River, on the Lillooet River, and on the Cheakamus River. 5L46 will not affect any of these.

Management of potential impacts will include:

1. Minimization of all clearing adjacent to watercourses, particularly where they are steeply incised.

2. Hand clearing of riparian vegetation with potential to conflict with the transmission line to a distance of at least 10 m from high water mark.

3. Hand clearing of any area adjacent to a watercourse that is unstable or prone to erosion.

4. Use of existing access roads and crossings where available.

5. Design of any new road crossings of watercourses to allow fish passage, where it occurs.

6. Design of any road drainage system to avoid siltation of adjacent watercourse.

B.4.2.7 Water Use

Ninety-five water licences have been identified on 73 water sources along the proposed route. Fifty five of the water licences are in the section between Shalalth and Gates Lake.

Sources used for community supplies are Omin Brook, McGillivary Creek, Coleman Spring, D'Arcy Creek, Rideau Brook, Alta Creek, Hill Creek, Alpha Creek and Vanwest Brook.

Environmental impacts to be controlled or managed include:

1. Damage to intakes or pipes.

2. Siltation of sources.

3. Introduction of contaminants to domestic water supplies.

Management of these impacts will include:

1. Meeting with all licensed water users to determine location of intakes and pipes, and to learn their concerns.

2. Design of clearing and construction, including access roads, to prevent damage to facilities.

3. Appropriate design of all stream crossings on licensed streams.

4. Repair of any damaged facilities.

5. Hand clearing of all areas within 10 m of a licensed source with downstream intakes.

6. Hand clearing on all sites prone to erosion on licensed sources above intakes.

7. No burning of debris near water sources.

8. Reseeding of disturbed areas.

9. Establishment of locations where herbicides will not be used.

B.4.2.8 Recreation and Visual Resources

The varied terrain and vegetation of the study area create many highly scenic areas very attractive for recreation. The contrasting landscapes of Pavilion Mountain and the Fraser Canyon have provincial significance. The Bridge River valley is of great scenic appeal because of its terrain and the dry forest. The Anderson Lake valley is a large scale landscape with very attractive features. Pemberton and Mount Currie are set in a dramatic valley with very pleasing contrasts.

A major objective in locating the proposed route has been to reduce the visual impact of 5L46 in areas that are important for scenic qualities and for recreation. This has resulted in moving away from the existing 2L1 ROW in D'Arcy, Gates River Valley, Pemberton, Nairn Falls Park, and from south of Whistler to Cheekye. Much care has been exercised in trying to reduce the visual impact through Whistler by careful adjustment of the route.

Positive project impacts would result from the removal of 2L1 and the location of 5L46 off the 2L1 ROW for the following lengths:

Seton Portage	6 km
D'Arcy	4 km
Gates River Valley	12 km
Pemberton	8 km
Highway 99, Pemberton to Green River Station	11 km
Green Lake	2 km
Highway 99, Function Junction to Brandywine Falls Provincial Park	8 km
Brandywine Falls Provincial Park	1.5 km
Highway 99, Pinecrest to head of Cheakamus Canyon	10 km
Lower Cheakamus Valley	9 km

High visual impacts are anticipated at Pavilion Village, at the crossing of Highway 12 south of Pavilion and the Fraser Canyon, and in the Bridge River valley. At Pavilion Village, 5L46 would traverse the slopes opposite the village in full view from it. Minor visual impacts are anticipated on Pavilion Mountain where the presence of an additional line will be introduced into a pleasant pastoral landscape.

At Highway 12, 5L46 will descend a steep bare slope above the highway and cross 5L41, 2L90 and 2L91 in full view from the highway and the railway. The crossing of the benches on the east side of the Fraser Canyon and the Canyon will be in full view from the highway and the railway. The crossing of the bare bench on the west side of the Canyon will be in full view of the adjacent ranch homes.

In the Bridge River valley there will be a change to a landscape of regional significance. The descent to Applespring Creek and the long traverse of the parkland forest on the south facing slopes of the valley will be highly visible from the road.

The crossing site of the Bridge River is close to a small group of houses and may form a major intrusion into their views.

Between D'Arcy and Pemberton Pass visual impacts are predominantly moderate with some small sections of high impact.

Moderate visual impact is anticipated at Pemberton, Nairn Falls Provincial Park, Whistler and Rubble Creek. At Pemberton the construction of a second line adjacent to 5L42 will create a greater visual impact for nearby residents. The clearing of a new ROW over Signal Hill will be visible in the view of Mount Currie from Pemberton.

At Nairn Falls Provincial Park, a new ROW will be required across the western leg of the park (0.5 km) adjacent to 5L42. The additional line will have some incremental impact.

At Whistler the visual impacts are moderate as 5L46 is replacing 2L1 but the structures are taller and the conductors heavier, increasing their visibility.

The route crosses the western end of a recent extension to Garibaldi Provincial Park at Rubble Creek. The site is sensitive as it is the major access point to an important provincial park near Vancouver. The project can be constructed without impairing the views from the Barrier and with only a moderate impact to travellers on the access road.

Minor visual impacts are anticipated in the Cheakamus River valley. 5L46 would be seen intermittently by travellers on Highway 99, and it will have a slight intrusion into the view from Pinecrest Estates and Black Tusk Village.

Mitigation for these impacts has already been incorporated through careful location and proposed measures to restore the cleared ROW.

B.4.2.9 Land Use

Land use considerations have been a factor in the selection of the route at the following locations. Any adverse impacts are noted:

1. Pavilion Mountain: There may be some impact on farming activities (note that the line may be located on the west side of the existing lines at the request of the owner).

2. Anderson Lake: Use of existing ROW avoids affecting adjacent land use which is all compatible with the existing ROW.

3. D'Arcy: Selection of a new route releases 2L1 ROW within the settled area of the village and reduces dissection of developable land on the Blackwater Creek fan.

4. Gates River Valley: Location of the route on the north facing slope of the valley releases the 2L1 ROW on the valley floor, reduces visual impacts for local residents, and improves land use opportunities at Gates Lake.

5. Pemberton: Location adjacent to 5L42 removes restriction of 2L1 (3 km) from the village and adjacent area. However, it reduces development potential for 2 km in a rural area.

6. Nairn Falls Provincial Park: The location of the campsite limits the location for the new line.

7. Whistler: Use of the 2L1 ROW from Green Lake to Function Junction with minor amendments, minimizes land use conflicts.

8. Cheakamus River Valley: Adoption of the High Cheakamus route avoids land use conflicts in Callaghan Creek valley, Brandywine Provincial Park, Pinecrest Estates and Black Tusk Village, Lucille Lake, the Lower Cheakamus Valley, Brohm Lake recreation site and the former B.C. Hydro Recreation Area at Stanley Lake. It creates new land use conflicts at the Rubble Creek extension to Garibaldi Provincial Park and at two cabins near Swift Creek.

The procedures for reducing land use impacts will be:

1. Consultation with all private land owners to determine their requirements on the finished state of the ROW and desired access routes.

2. Consultation with Crown agencies to determine their requirements for finished condition of ROW, restrictions during construction, and new access roads.

3. Making the ROW compatible with adjacent land use.

4. Repairing all fences, boundary markers, etc.

B.4.3 Summary of Potential Impacts for Alternative Routes

This section summarizes potential environmental impacts of construction and operation of 5L46 on the alternative routes (see Figures 1-4).

Route alternatives that traverse the Pavilion IRI, the Bridge River IRI, Seton lake IR5A and Nequatque IR1 recognize the potential for agreement with the affected Indian Bands to route the lines across their respective Reserves. From an environmental, technical and public consultation point of view, these routes are "generally favoured" over those routes which bypass the Reserves.

A route alternative that bypasses the developed section of the Municipality of Whistler is also included.

B.4.3.1 Pavilion IR1 (namely part of Pavilion WCE (to replace East Pavilion WW1DE))

Terrain: WCE has low impact potential as all access roads are already in place.

Forestry and Vegetation: WCE is in an arid area adjacent to Fraser Canyon and impacts on forestry are very low. Some sensitive sites occur near the east side of the Fraser Crossing.

Agriculture and Grazing: WCE has no impact on agriculture and has low potential impact on grazing on Pavilion IR1.

Wildlife: WCE has moderate impact potential on wildlife as it involves construction adjacent to the sheep range in the Fraser Canyon but makes very little change to the habitat along its length.

Heritage: With protection of known sites, WCE has low impact potential.

Fish: WCE has low impact potential.

Water Use: WCE has no impact potential.

Recreation and Visual: WCE has only low impact potential as the crossing of the canyon is adjacent to 5L42 and the site is largely concealed from view from Highway 12. It skirts the rear of the ranch homes west of the Fraser and is out of sight from Pavilion Village.

Land Use: WCE has no land use conflicts.

B.4.3.2 Bridge River IR1, namely part of Pavilion (F1F) and Mission (FG) (to replace Bridge (F1X) and Part of Antoine (XVG))

Terrain: Impact potential is low as roads have already been developed.

Forestry and Vegetation: Clearing for F1FG is less since it is adjacent to 5L42. F1FG has moderate forestry impact on Mission Ridge, and some sensitive sites are crossed in subalpine area.

Agriculture and Grazing: F1FG crosses 1 km of land on Bridge River IR1 used for pasture. It would enhance grazing opportunities on Mission Ridge.

Wildlife: F1FG has low impact potential due to existing 5L42 and related access roads.

Heritage: Possible disturbance of known sites on Camelsfoot Range and Bridge River IR1, one of very high importance.

Fish: F1FG has low impact potential.

Water Use: F1FG has low impact potential.

Recreation and Visual: F1FG has moderate visual impact potential on Mission Ridge.

Land Use: F1FG would impose an incremental impact on developable land in Bridge River IR1.

B.4.3.3 Seton Lake IR5A (to replace G1G2 outside reserve)

Terrain: Seton Reserve is located on a bench below the steep side hill on which G1G2 is located outside the reserve. Terrain impact potential is low as access roads already exist for 5L42.

Forestry and Vegetation: Clearing for the reserve route would be less as it is adjacent to 5L42. Site restoration on the reserve route is easier as it is less steep.

Agriculture and Grazing: No impact potential.

Wildlife: The reserve route creates less habitat disturbance and no extension of access roads. The impact potential is very low.

Heritage: Low potential impact.

Fish: No impact potential.

Recreation and Visual: The reserve route has lower visual impact potential as it avoids the need for two crossovers of 5L42 and a further clearing on the slope above Seton Portage, but is not visible from village.

Land Use: No land use conflicts.

B.4.3.4 Nequatque IR1 (to replace routing between 2L2 and 5L42 which are located between Nequatque IR1 and Anderson Lake IR1)

The impacts anticipated by siting 5L46 adjacent to 3L2 through the Nequatque IR5 are incremental only.

Terrain: Potential terrain impacts could accrue from the construction of access roads across the gravelly fluvial-colluvial apron along the lower slopes above Anderson Lake.

Wildlife: Low potential impact.

Heritage: Low potential heritage impact.

Fish: No impact potential.

Recreation and Visual: Low impact potential due to the existing lines.

Land Use and Agriculture: Low impact potential due to the existing line.

B.4.3.5 Soo-Rainbow (to replace routing through the Municipality of Whistler)

Terrain: The route lies over the toe of the north facing valley slopes well above the wetlands. No impacts anticipated on wetlands. Steep side slopes of Rainbow Pass have extensive scree and talus slopes along the lower slopes. Impacts of road construction could create instability.

Forestry and Vegetation: High potential forestry impacts due to loss of productive growing sites.

Wildlife: Potential impacts on wildlife assessed as moderate to high due to the variety of wildlife associated with the varied habitat.

Heritage: Low heritage potential.

Fish: Limited impacts on fish.

Recreation and Visual: High visual impact anticipated at Green River valley and Highway 99 crossings. Recreation impacts would be high due to the growing recreation importance of the general area.

Social: Low social impact potential.

Land Use and Agriculture: Proposals have been requested for development of the Callaghan valley. The transmission line would detract from the visual appeal of this zone and complicate development planning.

B.4.4 *Potential Impacts of Removal of 2L1*

This section assumes that 2L1 will be removed from the Bridge River Terminal to Cheekye. If 2L1 is physically removed the ROW may not be released if it is required for future use, to maintain existing lines, or other reasons.

The Ministry of Forests has requested that where the 2L1 ROW is released on Crown Lands in provincial forests that have adequate forest capability that B.C. Hydro replant the ROW. It is acknowledged that forestry is the most appropriate use of the land within a provincial forest. Areas of abandoned 2L1 ROW that do not contain (or are not expected to contain) naturally regenerated young conifers will be replanted. Any young trees planted will be tended until they reach "free-to-grow" status.

The site specific potential impacts are as follows:

1. km 0 - 6 (Seton Portage): This is an area very rich in heritage sites. These need to be located and protected during line removal. Removal of ROW will increase the potential for development.

2. km 6 - 25 (Anderson Lake): This section crosses many water supplies. These need to be protected.

3. km 25 - 30 (D'Arcy): Removal of 2L1 through the village will reduce visual impact and improve land use. Heritage sites need to be identified and protected.

4. km 30 - 43 (Gates River Valley): Removal of 2L1 will greatly reduce visual impacts of existing lines on local residents and add to the limited supply of developable land. It will improve the visual impact at Gates Lake.

5. km 43 - 61 (Birkenhead River Valley):. No negative impacts are anticipated.

6. km 61 - 78 (Pemberton to Green River Station): Removal will be done when soil is dry and after cropping is finished in the Pemberton valley. Release of the ROW will improve visual impact in Pemberton, on the south approach to Pemberton, at One Mile

Lake Park, and at the entrance to Nairn Falls Provincial Park. It will free land for development in Pemberton.

7. km 78 - 94 (Green River Station to Alta Lake): Low impacts are anticipated. Removal of towers in Alta Lake wetlands will be done after growing season is over and any temporary access roads to tower sites will be removed.

8. km 94 - 109 (Alta Lake to Brandywine): Removal of 2L1 along Highway 99 from Function Junction south of Whistler will greatly reduce present level of visual impact.

   Removal of 2L1 from Brandywine Provincial Park and adjacent UREP Reserve will increase potential of this area for recreation.

9. km 109 - 118 (Brandywine to Cheakamus Canyon): Removal of 2L1 will reduce visual impact at Black Tusk Village and Pinecrest Estates, in B.C. Hydro's recreation area at Stanley Lake and at Lucille Lake. Small wetlands will not be impacted. One tower on an island in a lake will require special measures.

10. km 118 - 124 (Cheakamus Canyon): Removal of 2L1 will greatly reduce visual impact of the transmission lines at the head of the canyon when viewed from Highway 99 and the BCR.

11. km 124 - 137 (Lower Cheakamus River Valley): Removal of 2L1 will reduce visual impacts in this rural residential area. Release of 2L1 ROW will permit designation of B.C. Hydro service road as a legal access road, and make more developable land available.

B.4.5 Socio-Economic Analysis

5L46's ROW is close to Pavilion Village, Lillooet, Shalalth, Seton Portage, D'Arcy, Pemberton, Mt. Currie, Whistler and Squamish.

The construction of 5L46 will require successive crews, each working only a short time in any given area. During the five years of construction, it is estimated that approximately 160 person-years of employment will be generated in the field.

The transmission line construction activities will benefit the region through some local contracts, employment, and spending. All of these are expected to occur but none will significantly impact the regional economy. Economic opportunities will probably be the greatest during the earlier phases of clearing and foundation construction because local skills and equipment will best match these activities. The tower erection and stringing activities are more specialized and will draw skills and equipment from a wider geographical area. Many of these tasks will be contracted out, although certain portions may be carried out by B.C. Hydro's own construction forces. In this regard, local contractors will be invited to bid on the specific tasks.

Representatives of several of the native Bands have advised of their interest in undertaking clearing contracts for the project or for maintaining lengths of new or existing ROW in their area. It is recognized that these activities could complement several of the seasonal activities of Band members and B.C. Hydro is developing means to assist Bands (and all or other local contractors) to compete for these contracts.

B.C. Hydro's consultants have predicted that there will be a shortage of accommodation for project workers in the northern part of the project area. It is proposed to contract, or erect and run, a construction camp at, or near Shalalth, for the duration of the project for B.C. Hydro staff and those of the contractors in the area, as it has done there before. For the rest of the project, it is anticipated that contractors will be responsible for their own accommodation.

Comments were received at some public meetings about a perceived increase in traffic congestion on Highway 99 caused by project-related vehicles. It is recognized that project traffic will increase the traffic flow, but as it will occur largely during the week, and in summer, it will not coincide with peak winter traffic to Whistler. None of the other roads in the project area suffer from congestion.

The community at Seton Portage has made several representations to B.C. Hydro with regard to their desired improvements of the "Highline" road from Seton Portage to D'Arcy. The effort the community has made to improve this road is recognized. After upcoming discussions with government agencies, it is planned to improve the "Highline" road as necessary for construction of 5L46, maintain it for the period of

construction, and then negotiate its transfer to the Ministry of Forests to form the basis for the major forest access road along Anderson Lake.

B.C. Hydro's service road in the lower Cheakamus River valley provides the only road access to many local residents. If 2L1 is removed between Rainbow and Cheekye, the future needs for ROW in the lower Cheakamus valley will be reviewed. If B.C. Hydro concludes that 2L1 ROW is surplus, it will be sold or released according to status, and to maximize the benefit to B.C. Hydro and its ratepayers, and local residents may then take the necessary steps to obtain legal status for the service road. If B.C. Hydro decides to retain the 2L1 ROW then the status of the road will remain as at present.

B.4.6 Specific Environmental and Socio-Economic Issues

B.4.6.1 Electromagnetic Fields (EMF)

Concern has been expressed by members of the public, regulators and elected officials regarding the possibility that exposure to the electromagnetic fields associated with transmission and distribution lines could have the potential to adversely affect human health.

Wherever there is electricity, there are electric and magnetic fields. The names of the two fields are often combined and referred to as electromagnetic fields or EMFs, although each type of field has different properties. Electromagnetic fields that alternate or change polarity result from an alternating current, or "AC" source of electricity. In Canada and in the United States this change in polarity occurs 60 times per second (usually referred to as a frequency of 60 Hertz). These fields are associated with all electrical appliances in homes and in workplaces, with the wiring that delivers electricity to houses and buildings, and with transmission lines.

Extensive studies have been carried out on the effects of these fields on human beings, laboratory animals, isolated cells and tissues, and livestock (both in the laboratory and in natural settings). Scientists have examined whether biological effects can be observed at electric or magnetic field strengths comparable to the highest levels that could be measured directly under a transmission line. In an effort to uncover any possible effects,

further experiments have also been conducted, in laboratory settings, using field intensities much higher than those under transmission lines or that would ever be experienced by humans or animals in everyday life.

A distinction must always be made between biological response or effects, and adverse or deleterious effects. The response of the eye to the turning on of the light in a room serves as a clear example of a biological effect that is not adverse.

Two basic approaches have been used by scientists to explore the question of adverse effects of EMF:

1. Laboratory studies, on human or animal experimental subjects, or isolated organs and cells.

2. Epidemiologic studies in human populations to look for an association between exposure to electromagnetic fields and various diseases.

Laboratory studies of humans exposed to intense electric and magnetic fields have not observed changes in basic physiologic processes (such as blood pressure, temperature, sleep, appetite and physical functions). Other studies have been conducted on mood and behaviour, and again these have not observed changes in humans.

However, these studies have documented that very strong electric fields can sometimes be felt, by the stimulation of body hair, much in the same way as we sense static electricity when combing our hair in dry winter weather. Other documented effects include minor changes in the brain wave activity seen when a person is exposed to light or sound. These minor changes are generally viewed as not harmful, and in these experiments the subjects' awareness, judgement and mood were unaffected. Similarly small was a change in heart rate of about three beats/minute, an amount comparable to that normally caused by a person taking a deep breath. This change was seen when subjects were exposed to strong magnetic fields which were turned on or off. The change did not occur during steady field exposure.

A response that has been documented in laboratory rats is a decrease in the production of a hormone called melatonin upon exposure to electric fields. The significance of this response is unclear, and no adverse consequences from this response have been reported.

Two recent epidemiological studies of childhood cancer have shown a weak correlation between cancer cases and proximity to certain types of distribution lines. However, no association was found between childhood cancer and measured magnetic field levels in these or any other study. In fact, the investigator who conducted one of the studies observed that "...it should be kept in mind that we have not proven that magnetic fields cause cancer". The consensus of the World Heath Organization, the New York State Power Lines Project, and Health and Welfare Canada, after evaluating all of the available data, is that no risk to human health resulting from exposure to electric or magnetic fields from power transmission lines has been established. A similar decision was reached by the B.C. Utilities Commission in July 1989.

Similarly, epidemiologic studies of the general health of workers exposed to electromagnetic fields examined physical and psychological well-being. These studies indicated that the workers were healthy and showed no indication of adverse effects from these exposures. Studies of the general population exposed to electromagnetic fields from powerlines also did not show any increase in the risk of developing cancer.

Research has also been conducted to determine whether the health and reproduction of farm animals living near or directly under high voltage transmission lines is affected. These studies indicated that exposure to the fields associated with transmission lines is not harmful to farm animals. For example, the fertility and reproductive success of cattle either penned or grazing freely under 400 kV transmission lines in Sweden was not different from cattle maintained far away from transmission lines. Similarly, a study in Iowa found that the growth and reproduction of pigs over several generations was not affected by living under a 345 kV transmission line.

B.C. Hydro has recognized that there is widespread public interest in the issue of human health risks from electromagnetic fields. B.C. Hydro has followed scientific developments, evaluated public and employee exposure, and participated in utility and technical forums on the subject. B.C. Hydro has recently provided funding to five health related studies by independent university and cancer agency researchers. B.C. Hydro has a full-time project manager to deal specifically with this important issue. In addition to internal technical experts, B.C. Hydro has also retained consultants with specific expertise to assist in evaluating research and providing advice on this matter.

In recognition of concerns about EMF, B.C. Hydro has taken practical steps to avoid exposing people by careful transmission line route selection. In addition, new transmission line structures which lower the fields relative to older designs are being designed and tested for use on this project.

B.C. Hydro is committed to the search for a better understanding of EMF effects and will continue to provide the latest information to the public and its own workforce.

B.4.6.2 The Use of Herbicides for Vegetation Management

It is B.C. Hydro's policy that vegetation management techniques shall, wherever appropriate, protect and enhance desirable low-growing vegetation. To this end, all of the options that are available including physical (manual or mechanical), chemical, and/or biological controls will be considered. The methods used will depend upon site ecological characteristics, land use goals and engineering needs.

Biological control is the objective. Long-term effective control at reasonable costs can only be realized by emphasizing biological control, i.e. discouraging the growth of the taller, undesirable plant species by encouraging and maintaining agriculture or Christmas tree farms, or by promoting a dense cover of low-growing, native vegetation.

Herbicides are used to control unwanted, tall-growing, deciduous plants and prevent their regeneration and allow biological controls

to be effective. Herbicide applications, under the Pesticide Control Act, are regulated by the Pesticide Control Branch. The conditions of the particular Pesticide Use Permit are supervised by a certified pesticide applicator. Herbicides will not be used on private land without the approval of the landowner.

The existing right-of-way has had a continuing maintenance program, including herbicide application and machine/hand-clearing, since 1976. A long-term vegetation management strategy for non-agricultural areas will be used to minimize the use of herbicides by:

1. using target species selective "cut and treat" and "injection" methods, and

2. by promoting desirable, compatible, low-growing vegetation.

B.4.6.3 Knapweed Spread

A special environmental problem associated with the northern section of 5L46 will be the spread of knapweed species (Centaurea diffusa and Centaurea maculosa). These can be spread quickly by vehicles and equipment and will colonize any recently disturbed ground. The prevention of extension of knapweed infestation in the area between Kelly Lake and the Bridge River Valley is a high priority of the Ministry of Agriculture, the Ministry of Forests, the Regional Districts, and of B.C. Hydro. Knapweed is now established near Kelly Lake Substation, and in other areas to the south.

The following control measures will be used:

1. Thoroughly cleaning, before transporting to the transmission right-of-way, any equipment brought from outside the area.

2. Reseeding disturbed ground to grasses after clearing and again after each phase of construction.

3. Follow-up surveys of seeded or infested areas.

4. Participating in, and contributing to, local (e.g. regional districts) noxious weed control programs.

B.4.6.4 TV and Radio Reception

Based on over 20 years experience with the operation of 500 kV lines throughout the province, it is believed that 5L46 would not increase television interference along the right-of-way. Furthermore, Canadian Standards Association (CSA) CAN3-C108.3.1-M84 states in Appendix E that generation of VHF noise (i.e., electromagnetic noise in the VHF television frequencies) is not usually an inherent property of a power line.

The CSA Standard includes a guideline for maximum radio noise of 57 dB at a lateral distance of 15 m from the outside conductor during fair weather. This same standard has been adopted by the federal Department of Communications in its proposed amendments to the radio interference regulations. The calculated maximum radio noise at this same lateral distance from 5L46 is 46 dB or less depending on tower configuration, which is below the CSA guideline.

During periods of rain, snow or fog, radio noise levels will increase but no guideline levels are provided in the CSA standard.

B.4.6.5 Audible Noise

It is estimated that the maximum audible noise level at the edge of the right-of-way during wet conditions (worst case) with 5L46 in place would be 48 dBA or less depending on tower configuration and the location of 5L46 relative to the existing circuits. Audible noise levels during fair weather would be lower. There are no CSA guidelines for audible noise.

SECTION C - PROJECT JUSTIFICATION

C.1 TECHNICAL, ECONOMIC AND FINANCIAL FEASIBILITY OF THE PROJECT

This section summarizes the results of technical and economic studies which justify building the proposed Kelly Lake to Cheekye Substation second 500 kV transmission line project by the fall of 1996.

B.C. Hydro's mission is to support the development of British Columbia through the efficient supply of electricity. B.C. Hydro has a responsibility to provide reliable electric service to its customers.

The existing B.C. Hydro bulk transmission system and the proposed second Kelly Lake to Cheekye line are shown in Figure 8. Most of B.C. Hydro's power demand or electric peak load is centred in the Lower Mainland and Vancouver Island regions. Most of the power supply to this load centre is served from the two major remote sources of generation: Peace River and Kemano surplus generation in the north, and Columbia River generation in the east.

The capacity of a transmission system to transmit power over long distances is limited by the thermal capacity of the lines, by electro-mechanical stability and by the supply of reactive power for voltage stability. Transmission system capacity deficiencies lead to increased operating complexity, decreased efficiency and a degradation of reliability.

The Interior to Lower Mainland transmission system is presently comprised of essentially five 500 kV lines: Kelly Lake to Ingledow; Kelly Lake to Cheekye; Nicola to Ingledow; Nicola to Meridian; and the Kelly Lake to Nicola line which allows sharing of transmission capability between the two sides of the system. Of these, the four lines into the Lower Mainland have series capacitors providing 50% series compensation. The proposed 50% series compensated Kelly Lake to Cheekye line would be the first line into the Lower Mainland in 20 years.

Northern generation capacity will be increased by 520 MW when Alcan's Kemano Completion Project goes into service in late 1994 or early 1995.* The eastern

*Recent developments could affect these dates.

generation could increase by more than 1500 MW over the next 20 years or so with the proposed resource developments in the Lower Columbia. In addition, there are expected to be industrial co-generation plants and Independent Power Producers (IPPs) located north of Kelly Lake and east of Nicola that would add to those totals.

Recent load growth in the Lower Mainland and on Vancouver Island will be supported by the American Creek series capacitor station north of Hope, completed in 1990. Anticipated near-term load growth will be supported by a dynamic reactive power supply source: a 200 Mvar static var compensator (SVC) at Dunsmuir Substation on Vancouver Island near Qualicum. The SVC is scheduled for service in fall 1993. By about 1995, further system reinforcement will be required if the electrical power demand continues to increase as forecast. B.C. Hydro is considering several options to meet the 1995/96 winter peak load.

The power transfer capability of the system is determined by power system computer simulation studies. The adequacy of this transmission capability is judged by its compliance with B.C. Hydro's single contingency planning criteria and the reliability criteria of the Western Systems Coordinating Council (WSCC). The WSCC criteria define the permissible degree of impact on neighbouring utility systems due to credible disturbances initiated within the system of a member utility such as B.C. Hydro.

The capability of B.C. Hydro's Interior to Lower Mainland transmission system is predominantly limited by voltage stability. If this system is not reinforced, an outage of one of the 500 kV lines under system heavy load or heavy transmission stressed conditions could cause a sudden collapse of voltages and a widespread blackout in the Lower Mainland, Vancouver Island and perhaps the Puget Sound region.

The voltage stability limitation is also affected by the generation pattern; the constraint is greater at high Peace or high Columbia generation. Therefore, voltage stability limits often restrict the flexibility of operation of the Peace and Columbia generating plants. Restrictions on generation dispatch have an adverse impact on the economic operation of the system.

The system is planned primarily to meet any single contingency outage. However, the security of supply to Vancouver Island and the Lower Mainland against credible second contingency line outages is also of growing concern. During prolonged outages of any one of the major Interior to Lower Mainland lines, a

subsequent outage of a second line is possible. Normally such situations are handled by redispatch and relying on load shedding. However, if the subsequent outage occurs under stressed conditions, it could result in significant load shedding with an attendant risk of voltage instability. Line and equipment outages are also becoming more and more difficult to schedule for essential system maintenance. Therefore selection of the recommended plan has considered the relative second contingency capability of the alternatives especially if they have similar costs.

Three studies were performed to determine the transmission system capacity requirements and the cost effective system reinforcement alternatives.

The **first study** established that the capability of the existing system with the system additions underway would be adequate only through the 1994/95 winter peak load period. It also assessed the sensitivity to changes in local and remote generation.

The **second study** evaluated approximately 35 different system alternatives to the proposed Kelly Lake to Cheekye transmission project for application in the mid 1990s. These included new transmission line alternatives and non-transmission alternatives and a review of emerging technologies. The technical and economic viability of all alternatives was screened with respect to their relative technical merit, cost, installation lead time and use of available and proven technology.

Among the non-transmission alternatives assessed were:

* adding static var compensators in the Lower Mainland for dynamic reactive power support;

* increasing the series compensation of the existing 500 kV lines in the Lower Mainland region;

* sectionalizing of some of the existing Interior to Lower Mainland 500 kV lines with a 500 kV switching station at Ruby Creek; and

* enhancement of the existing system's performance with automatic control technology.

The **third study** determined the effectiveness of the best individual alternatives as a part of a long term system development plan. The approach taken in this study was to consider two basic alternatives for system development:

Sequence 1: to assess the sequence of projects that includes transmission alternatives early; and,

Sequence 2: to assess the sequence of projects that postpones new transmission additions as long as possible by the addition of relatively lower capital cost non-transmission alternatives.

The results of the studies show that there is very little difference in the long-term costs of the two system development options. The savings in transmission losses offset the higher capital cost of the transmission alternatives. The technical advantages of using proven and readily available technology and of providing the greatest system development and operating flexibility clearly favour the "transmission first" approach. Additional transmission is shown to be ultimately the most efficient and economical solution to the system capacity and reliability problem.

The proposed Kelly Lake to Cheekye second 500 kV transmission project provides a most reliable and cost effective means of increasing the Interior to Lower Mainland transmission system capacity to meet load growth beyond 1996. The proposed line would:

* significantly reduce transmission losses which would cover, over its 45-year operating lifetime, approximately 114%, 86% or 66% of its total capital and operating costs, based on discount rates of 6%, 8% and 10%, respectively;

* provide flexibility in B.C. Hydro's plans to minimize the risk of inadequate reliable system capacity in the future to meet the high load forecast, changes in resource plans, unforeseen delays in local IPPs and other system additions;

* provide higher second contingency transfer capability than non-transmission options and, hence, significantly reduce the requirement to cut off supply to customers in the event of multiple outages of lines or station equipment;

* provide greater flexibility for maintenance of system lines and associated substation equipment (it is already becoming difficult to schedule outages for such necessary activities); and

* provide significant transmission capacity at peak load periods in the initial years and at off-peak periods over its lifetime which would increase the benefits of electrical trade of power and energy with the U.S. Pacific Northwest and for power pool transactions by the Power Exchange Operation

The benefit/cost ratio of Sequence 1 compared to Sequence 2 for first contingency reliability and savings in losses is 1.15 at an 8% discount rate. It does not account for the unquantifiable benefits of increased flexibility for system operation and planning; benefits of reduced risk of blackouts due to multiple contingencies; and increased electrical trade within British Columbia and with Alberta and the United States.

It is concluded that the line should be constructed for service in 1996 to meet the increased domestic load and to maintain system reliability, efficiency and operating and planning flexibility.

C.2 PROJECT BENEFIT AND COST ANALYSIS

The benefit-cost analysis for the second Kelly Lake to Cheekye 500 kV transmission project was based on the mandate that any new load that appears on the system must be served reliably and economically. In other words, it is assumed that B.C. Hydro's customers are willing to pay to maintain the same degree of reliability that they now enjoy. It has been assumed that B.C. Hydro's Power Smart program will eliminate loads that are more economically served by other means and remaining load growth will be served by the installation of new plant and equipment. As well, this analysis assumes that the reliability of the system will be maintained as new loads are added which require system additions that meet System Transmission Planning Criteria.

The benefits and costs of the project were determined by comparing alternatives that serve the load and maintain a similar degree of reliability. Second-order differences in reliability are discussed but are not valued in the analysis. The benefit-cost calculation for the proposed project compares the two long-term sequences. Sequence 1 has new transmission installed first while Sequence 2 has non-transmission alternatives installed first. The sequence analysis assesses whether the line can be delayed and the technical implications and economics of delay. The benefit/cost ratio of Sequence 1 is determined by dividing the present value of the loss savings of Sequence 1 less Sequence 2 by the present value of the aggregate annual cost of Sequence 1 less Sequence 2.

C.2.1 Quantified Benefits

The benefit/cost ratio of Sequence 1 compared to Sequence 2 for first contingency reliability and loss savings is 1.15 at an 8% discount rate.

(a) Increased First Contingency Power Transfer Capability

The line is proposed to serve increasing load in the Lower Mainland and Vancouver Island. A reasonable method of valuing the benefit of staging this line in 1996 instead of a later date is to compare Sequence 1 against Sequence 2.

(b) Savings in Capacity and Energy Line Losses

The savings in losses for the long-term sequences are shown in Table 1. The long term savings in losses due to the proposed line alone are shown in Table 2. It is estimated that 86% of the capital cost of 5L46 could be directly recovered in line losses at an 8% discount rate and 114% at a 6% discount rate. Clearly the line is "Resource Smart" and would help meet the Corporate objective of being an efficient supplier of electricity.

C.2.2 Unquantified Benefits

(a) Increased Interruptible Exports, Coordination, Short-Term Sales

The second Kelly Lake to Cheekye 500 kV transmission line could be used during off-peak hours for secondary energy exports to the United States, coordination exchanges and even short term firm exports if any surplus capacity is available in the initial years of service.

(b) Second Contingency Capacity and Security of Supply to Vancouver Island

In the last 10 years there have been three instances of extended outages of more than a day's duration of the existing Kelly Lake to Cheekye 500 kV transmission line (circuit 5L42). The most recent occurrence of an extended outage of 5L42 began on 11 November 1990, when heavy rain and flooding caused the

failure of two towers. It took 13 days to restore that circuit to service requiring crews to work 16 hour days, seven days a week under quite adverse conditions.

Security of the Vancouver Island system becomes vulnerable during such extended outages of 5L42, especially to a concurrent outage of the existing 500 kV transmission line between Meridian and Cheekye substations (circuit 5L45). Circuit 5L45 terminates at Cheekye Substation and from there delivers supply to the Sechelt Peninsula and Powell River and to Vancouver Island via the 500 kV submarine cables. An outage of 5L45 during an outage of 5L42 at high load levels could cause a cascading failure or blackout of the whole Vancouver Island system and the Sunshine Coast. The proposed project would provide a third supply to Cheekye Substation and improve reliability of supply to Vancouver Island.

(c) Utilization of the New Line

Of the four lines (5L41, 5L42, 5L81, 5L82) that directly supply the Lower Mainland load centre through Kelly Lake, Nicola and Cheekye substations, circuit 5L42 is heavily loaded since it also carries a large proportion of the power supply for the Sechelt and Powell River areas and for Vancouver Island. The proposed new line, 5L46, parallel to 5L42, would increase the number of 500 kV lines directly supplying the Lower Mainland from four to five and would provide a more equal sharing of power. In other words, the new line would be well utilized as it would carry a substantial amount of power: about 1000 MW during system peak load. The new line would be well utilized not only in the near-term but also in the long-term.

(d) Increased Flexibility of System Operation

The proposed new 500 kV transmission line between Kelly Lake and Cheekye substations would add considerable flexibility for system operation. This would be in terms of the ability to vary the Peace, Columbia and Coastal generation for optimum utilization of resources; the ability to take maximum advantage of opportunities for electricity trade with Alberta and the U.S.; and the ability to

better schedule line outages for equipment maintenance. This increased flexibility benefit is difficult to measure. For instance, in June 1990, when both 500 kV lines connecting Revelstoke Generation (1850 MW) on the Columbia River to the transmission system in the Southern Interior were out for several days due to massive mud slides, B.C. Hydro also had to curtail all generation at Mica Generation (1750 MW), upstream of Revelstoke. This meant that B.C. Hydro had to increase output at the Peace River generating plants to make up the deficit. If the transmission capacity on the west side of the Interior to Lower Mainland system had been inadequate, as it would be in future years with only the existing system, it would have meant purchase of power from Bonneville Power Administration (BPA) or other northwest U.S. utilities.

(e) Planning Flexibility

The 1996 in-service date is based on serving domestic load only. That date allows some flexibility to meet a higher than forecast load, unknown firm exports or changes in the Electricity Plan. With the line planned to be in-service to meet the probable load, the capacity of the system could be quickly increased by advancing installation of the planned SVC at Ingledow Substation to an earlier in-service date. If the load growth is lower than forecast, then the in-service date of the line could be delayed a few years. The benefit of this flexibility has not been quantified in this analysis.

SECTION D - ANCILLARY APPLICATIONS

D.1 WASTE MANAGEMENT ACT AND WATER ACT

Approvals, permits and licenses may be required under the Waste Management Act and the Water Act for construction work and camp operation. Such permits are not being sought as part of this present Application but will be sought if this Application is approved.

D.2 OTHER APPROVALS, PERMITS, OR LICENCES THAT MAY BE REQUIRED

The following also may be required in connection with the proposed project:

1. Special case authorizations under the Agricultural Land Commission Act.
2. Authorizations or acquisitions under the Land Act.
3. Licences to cut under the Forest Act.
4. Permits to cross pipelines and railroads.
5. Permits under the Navigable Waters Protection Act.
6. Approvals under the Heritage Conservation Act.
7. Permits under the Indian Act and Band Council Resolutions for route alternatives through Indian Reserves.
8. Permits under the Park Act.
9. Miscellaneous approvals, permits and licenses routinely required from time to time for construction work and camp operation.

SECTION E - PUBLIC CONSULTATION PROGRAM

E.1 INTRODUCTION

Public consultation continues to be a substantial and integral part of B.C. Hydro's project planning for the proposed Kelly Lake to Cheekye Second 500 kV transmission line. With effective consultation, B.C. Hydro is in a better position to identify and address the issues or concerns identified by the public and make better planning decisions which benefit all our customers. B.C. Hydro anticipates that the decisions made by governments, regulators and the general public will also benefit from this public involvement.

B.C. Hydro conducted a public information and consultation program when the project was studied in the early 1980s. That program commenced with release of the project prospectus in the Fall of 1980 and took place over the next two years until the project was set aside when projections in the demand for electricity were reduced.

The current public consultation program began in mid-1989, following the reactivation of technical and environmental studies earlier the same year. Synergistics Consulting Ltd. provided consultation advice and support to the project team, who were responsible for the implementation and overall direction of the current program.

The goal of the current consultation program was to address issues and concerns identified by the public, respond to these concerns, and reflect these comments and concerns, wherever possible, in project planning.

The objectives identified to meet this goal were:

- to foster broad-based understanding of the need for the transmission line and the project planning process;
- to provide on-going opportunities for residents in affected communities and B.C. Hydro to exchange information and views, and to report on project specific issues raised by the communities;
- to stimulate public discussion of alternative routes and provide opportunities for the public to assist in route selection; and

- to demonstrate B.C. Hydro's commitment to respond to community concerns in an open and straight-forward manner.

The area of study for public consultation purposes was a broad corridor stretching from Clinton in the north to Squamish in the south. This area also included the communities of Lillooet, Shalalth, Seton Portage, Birken, Pemberton, Whistler and Squamish. Some individuals and groups residing beyond the area of study were also involved in the consultation program. All requests for information, regardless of geographic origin were responded to as there were several non-resident property owners with interests in the project.

A separate consultation program was carried out with native Bands. This is summarized in Section E.5.

The current public consultation program was undertaken in several phases. The first two phases of the program, documented in the Public Consultation Report by Synergistics Consulting Ltd., Phases 1 and 2, occurred from 1 May - 30 November 1989 and mid-April to 30 September 1990, respectively. The third phase of the program, documented in an Addendum to the Synergistics Consulting Ltd. report, reflected consultation activities that occurred from 1 October 1990 - 28 February 1991.

This section of the Application provides a summary of the events current as of May 1991. Project-related consultation activities and communications with the public are ongoing and will be documented in future consultation reports or updates.

This section also provides a summary of the project public consultation activities, findings, analyses and recommendations for further consultation.

E.2 PHASES 1 AND 2 (MAY - NOVEMBER 1989 AND APRIL - SEPTEMBER 1990)

The first phase of the consultation program involved contact by letter and telephone with elected officials, interest groups and individuals in the study area to inform them about the project studies underway and solicit feedback on the consultation program proposed. Discussions with B.C. Hydro employees in the area and community interviews with key stakeholders were also held. A press release formally announced the project studies in June of 1989.

The first project newsletter outlined the routing options under consideration and described the need for the transmission line. This information was widely distributed in the study area and to key stakeholders in September of 1989. Background information on the project was provided through the Preliminary Planning Report (May 1990) and a Planning Perspective (March 1990) report, which underwent Provincial government interministerial review (fall 1990).

Open Houses were held at eight locations during October of 1989 to review the route options with the public and present project information. Following the open houses, meetings and discussions were held with a number of interest groups in the area to identify their concerns and issues regarding the project.

The first phase of the consultation program, along with the environmental and technical study findings provided in November of 1989, led to a generally favoured route. This route followed the existing 230 kV transmission line (2L1), with some alterations. In some areas, however, a generally favoured route could not be identified (including the Lower Cheakamus area, Whistler and Indian Reserves), and further study of routing options in these locations was initiated.

This generally favoured route was presented in the second phase of the consultation program. A newsletter was widely distributed throughout the study area in May of 1990, followed by public open houses in seven locations during June. Optional routings for Whistler and the Lower Cheakamus were presented for public review and discussion. A series of interest group meetings were held concurrently with the open houses.

The consultation program identified strong support for the generally favoured route and limited interest in alternative routes through wilderness areas. Residents of the Lower Cheakamus were supportive of the High Cheakamus route option which would see removal of an existing 230 kV transmission line (2L1) from the valley. The Pavilion Route was favoured over the Antoine and Bridge routes, especially by residents of the community in the Moha area west of Lillooet in the Antoine Creek, Applespring Creek and Yalakom River valleys. These people are adamantly opposed to the Antoine and Bridge options. The Anderson Route was favoured over the Duffey route, based on a desire primarily by the Village of Lillooet and the Squamish-Lillooet Regional District, to preserve the natural qualities of the Duffey route. Routing preferences in the Municipality of Whistler remained unresolved.

The main issues identified in the first two phases of the consultation program are listed below. The order of the issues does not reflect their importance.

E.2.1 Project Justification/Long Range Planning

Project Justification - need for the line and its relationship to electricity exports.

Electricity Export - opposition to the concept of firm electricity export contracts.

Energy Conservation - interest in seeing B.C. Hydro make a greater commitment to energy conservation.

Benefits for Impacted Communities - a desire for jobs and other benefits for communities that bear the direct impacts of development.

Future Development - protection of prime developable land in valley bottoms.

Long Range Planning - a concern that more transmission lines would be built in the corridor in the future.

E.2.2 Property and Visual Impacts

Property Values and Other Property Impacts - potential for project to decrease property values, and negative impacts on privacy and the rural lifestyle.

Visual Impacts - the need for Hydro to reduce adverse visual impacts.

Release of 2L1 ROW - desire to have Hydro release easements for the ROW where it is not required for the proposed project.

E.2.3 Health and Environment

EMF effects - potential health risks from electric and magnetic fields.

Environmental Impacts - protection of wilderness by keeping lines in existing corridor.

Vegetation Management - opposition to use of chemical herbicides on the right-of-way; support for biological control of vegetation on ROWs.

PCB Storage - although not directly project-related, concern exists in Birken/Gates Lake and Pemberton areas that B.C. Hydro has not adequately addressed the issue of secure storage of PCBs and related equipment and materials.

E.3 PHASE 3 (OCTOBER 1990 - FEBRUARY 1991)

The third phase of the consultation program, which occurred from October 1990 to the end of February 1991, was designed to continue discussions on transmission line routing, especially in areas where a generally favoured route had not yet been identified, to update interested groups, individuals, and potentially affected property owners about the project planning process, and to continue to respond to public inquiries about the project.

The third phase of consultation involved meetings and discussions with residents and other key stakeholders, primarily regarding the High Cheakamus, Whistler (Garibaldi), Bridge, and Pemberton routings. A third project newsletter was distributed throughout the area of study and to those on the mailing list in late February 1991. The newsletter identified the proposed route, which would be reflected in the Application for an Energy Project Certificate, and the alternative routes through Indian Reserves which would be used if agreements with the Bands were reached. The newsletter also noted the replacement of the previous generally favoured route south of Daisy Lake by the High Cheakamus route, which resulted from discussions with residents and property owners held during the second phase of consultation.

Studies were also initiated on the Pinecrest East and West alternatives, which could replace the northern part of the High Cheakamus route.

Meetings with some Pemberton residents in early February 1991 identified concerns regarding the routing through the Pemberton valley. Further discussions with residents were proposed.

A meeting was held with the Municipality of Whistler during the third phase of the consultation program. No clear preferences on routing were identified.

Issues identified in the third phase of the consultation program became more route or area specific. The following issues/concerns, in no specific order of importance, were raised:

Pinecrest Estates/Black Tusk Village Residents

- visual impacts.
- potential EMF effects
- proximity of the transmission line
- the removal of 2L1
- a comparison of High Cheakamus to the Pinecrest East and West alternatives

Pemberton Residents

- excessive use of the Pemberton valley for transmission lines
- justification for not using the Elaho or Hurley alternatives
- potential EMF effects
- long term use of the corridor
- lack of representation on SLRD Advisory Group
- land use restrictions (residential development) created by transmission lines

Antoine Creek/Applespring Creek Residents

- utilize the existing corridor through Pavilion and Bridge River Indian Reserves
- negotiate with Pavilion and Bridge River Bands, and the Lillooet Tribal Council
- apply for approval of the project based on the generally favoured route through the Indian Reserves
- concern that a transmission line in their area would have severe lifestyle impacts
- project justification - B.C. Hydro should put more effort into electricity conservation programs
- concern that opening up a new ROW would have an impact on wildlife and increase access to hunting and wilderness areas
- concern about B.C. Hydro's vegetation management policy
- potential EMF effects

Municipality of Whistler

- impact of the transmission line on the Municipality
- location of future transmission lines
- need for independent advice to review transmission line justification

- need for independent advice on EMF effects

E.4 RECENT CONSULTATION ACTIVITY (MARCH - MAY 1991)

The documentation of consultation activities accompanying this Application is current to 28 February 1991. The purpose of this section is to provide the current status of the consultation activity. Future updates and/or consultation reports will be prepared at key milestones to provide updated summaries of the consultation activity, public concerns and B.C. Hydro's response.

The consultation activity between March and May 1991 was, in general, a continuation of the third phase of the program. Discussions with residents and key stakeholders were held to review routing options, especially in the Whistler (Garibaldi) and Pemberton areas, where no routing consensus had yet been reached. Meetings and discussions continued with property owners and resource agencies, and responses to public inquiries and concerns were provided.

An open house/meeting was held in Brackendale on 14 March 1991 to review the results of the Pinecrest East and West studies with Lower Cheakamus residents and with the residents of Pinecrest Estates and Black Tusk Village. There was general support identified for the High Cheakamus route, based on the meeting discussions and the results of the environmental and technical studies.

As follow-up to a previous 4 February 1991 meeting with a small group of Pemberton Valley property owners, a larger meeting was held with Pemberton Valley property owners in March of 1991. At the meeting, B.C. Hydro offered to investigate the technical and environmental merits of several other route options in the Lillooet River Valley and report the results to area residents. A petition was presented by Pemberton area residents to B.C. Hydro in April 1991, noting opposition to the routing through the Lillooet River Valley. A response to the petition was provided to the legible signatories and an advertisement was placed in the local newspapers, noting the studies that were being undertaken and advising that their results would be presented to interested residents in the Pemberton area (these results were presented at an open house/public meeting in June 1991. A report outlining the environmental and technical routing studies, together with a summary of the comments received from the public, will be prepared and submitted.).

Further meetings and discussions were held with the Municipality of Whistler. However, support for routing through Whistler remains unresolved. The Squamish-Lillooet Regional District expressed concerns about the routing of the

transmission line in selected areas and the lack of involvement of the SLRD Advisory Group. B.C. Hydro responded to the concerns raised and reiterated its offer to meet again with the Advisory Group which reports to the Regional District Board.

B.C. Hydro also met with the Ministry of Parks (13 March, 2 April and 16 May 1991), the Ministry of Forests (24 April 1991) and Transport Canada (16 May) to discuss transmission line routing.

Issues raised during the more recent consultations include, in no order of priority:

Squamish-Lillooet Regional District (SLRD): public consultation program; Bridge routing; Advisory Group involvement

Municipality of Whistler: visibility; undergrounding distribution lines; project justification

Pemberton Residents: land impacts; visibility; routing options; social impacts, numoer of existing lines in the valley; inability to sell property located on potential routes with project studies underway

Yalakom and Lillooet Residents: Bridge routing; potential interference with TV signals; wildlife impacts; negotiations with native Bands

Ministry of Parks (High Cheakamus): visibility; park intrusion; effect on helicopter access route

Ministry of Forests (High Cheakamus): forest resource loss; visibility

E.5 NATIVE CONSULTATION

Throughout the current Kelly Lake to Cheekye Substation Second 500 kV transmission line public consultation process, B.C. Hydro provided Indian Bands in the study area with information on the project planning and with opportunity to participate in the process. The office of the Lillooet Tribal Council, as well as the following Bands, were included in mailouts and newsletter distribution:

Anderson Lake	Bridge River	Cayoose Creek
Fountain	Lillooet	Mount Currie
Pavilion	Seton Lake	Squamish

Information was also conveyed to the Whispering Pines Band located north of Kamloops. They were former owners of the Kelly Lake Substation site, but received new reserve property in exchange for the property acquired by B.C. Hydro.

Meetings were held with Anderson Lake, Bridge River, Mount Currie, Pavilion and Seton Lake Bands. Meetings with the Lillooet Tribal Council occurred on several occasions with the Lillooet Tribal Council representing Bridge River, Cayoose Creek, Fountain, Lillooet, Pavilion and the Seton Lake Bands. An Open House session was also held on the Seton Lake Reserve at the request of the Seton Lake Band.

Several observations related to the project may be noted:

(a) Indian Bands and the Lillooet Tribal Council generally wish to see past issues and grievances with B.C. Hydro settled prior to discussing new project issues.

(b) The generally favoured route through Pavilion, Bridge River and Seton Lake Indian Reserves is supported by the Bands affected and the Lillooet Tribal Council based on minimizing impacts through their traditional territories by following existing corridors.

(c) B.C. Hydro will focus resources and effort in negotiating the required right-of-way through:

- Pavilion IR1
- Bridge River IR1
- Seton Lake IR5A
- Nequatque IR1 Reserves

to avoid the additional cost and the environmental impact of going around these Reserves.

(d) While the employment and native business opportunities on the project are limited, the following initiatives will be pursued by B.C. Hydro prior to project approval to enhance those opportunities:

- encourage native businesses and Bands within they study area to obtain training and skills needed to compete for project contracts

- provide opportunity to Indian Bands to clear ROWs on Reserves affected by project alternatives and investigate opportunities for involving Indian Bands in their ongoing maintenance

- ensure commitments to monitoring and communications are maintained

(e) Arrange project updates for the native communities at regular intervals during pre-approval and post-approval stages of the project.

The status of native consultation can be summarized as follows:

- The Bands represented by the Lillooet Tribal Council expressed willingness to negotiate with B.C. Hydro and several productive negotiating meetings were held. However, at the time of this Application, no agreement had been reached. The Bands did express that they wanted progress in addressing past grievances with B.C. Hydro in the negotiating process prior to addressing project related issues. The council also confirmed their view that they preferred to see the proposed new Kelly Lake-Cheekye transmission line follow the existing corridor through Pavilion, Bridge and Seton Reserves. Discussions with the Lillooet Tribal Council and the Bridge River, Cayoose Creek, Fountain, Lillooet, Pavilion, and Seton Lake Bands continue.

- A letter of clarification regarding right-of-way requirements was conveyed to the former Chief and council of the Anderson Lake Band. Negotiations continue with the current Chief regarding the required right-of-way for the Nequatque IR1 alternative. At the time of writing this Application, no agreement had been reached.

- B.C. Hydro met with the Mount Currie Band in October 1989, and on several subsequent occasions requested meetings to discuss the project and to discuss plans for an Energy Project Certificate Application. In April 1991, B.C. Hydro met with the Band Manager to discuss the project and was informed that the Band did not want to discuss project details until their land claim issues had been settled. The Band perceives B.C. Hydro to be a third party in their negotiations with the Federal and Provincial Governments. The Band also views B.C. Hydro as an extension of the Provincial Government. The Band Manager was informed of the proposed route and the route alternatives, and provided with project information. A request to the Chief of the Band for a follow-up meeting

was made, but a meeting had not yet been confirmed at the time of writing this Application.

- The Squamish Band never formally expressed an opinion regarding the project or negotiations. A meeting with the Band's Economic Development Committee was requested and planned, but had not yet occurred at the time of this Application.

Given the above, this Application is based on a route which bypasses Indian Reserves. However, the "generally favoured" route options through selected reserves are included as alternatives should negotiations with the Lillooet Tribal Council and Bands be successful. Whether the generally favoured alternatives can be implemented will depend on the success and timing of subsequent ongoing negotiations. All negotiations with Bands on the generally favoured route must be completed by January 1992 to maintain the 1996 project in-service date.

E.6 FUTURE CONSULTATION DIRECTIONS AND COMMITMENTS

The response to B.C. Hydro's consultation program for the Kelly Lake-Cheekye program was generally very positive. Through comments received and in discussion with various property owners and interest groups, it was noted that B.C. Hydro's efforts to consult with the public had improved significantly from previous years. B.C. Hydro's commitment to an open communication process has been appreciated by the communities and groups who may be affected by the project.

In order to maintain and continue this communication and consultation activity, B.C. Hydro proposes to undertake the following activities:

(a) In the pre-approval stage:

- provide notification of submission of Application for an Energy Project Certificate to the mail list, including property owners, and Indian Bands and Tribal Councils, on all identified routes

- provide copies of the Application and supporting documents and reports to B.C. Hydro district offices, regional libraries and Information Centres (as defined in Phase 1 consultation)

- provide updates/consultation reports on recent consultation activity including confirmation of public concerns and issues to the Ministry of Energy, Mines and Petroleum Resources and the public, on request

- provide local contractors an opportunity to understand B.C. Hydro contract requirements and specifications for the project

- maintain the toll-free telephone line

- continue to respond to project - related inquiries/public information requests

- provide the results of specific routing studies to the Pemberton Valley residents

- meet with property owners, interest groups, agencies , Indian Bands and Tribal Councils, and others, upon invitation

- continue negotiations/consultation with Bands/Tribal Councils to reach agreement by January 1992 with the Bands and Tribal Councils affected by alternative routes

- update, as required, the Response Document and Summary of Commitments Report .

(b) In the post-approval stage (assuming approval to construct the project is granted)

- continue the consultation program through project design and construction to the early operational phase

- maintain dialogue with residents, elected officials, government agencies and key stakeholders with respect to their concerns and issues

- respond to project-related, and other, inquiries

- maintain the toll-free telephone line

- record, monitor and follow-up on project commitments

- provide project updates via newsletters or correspondence to interested parties, including the mail list

- provide interested area contractors with information about employment opportunities and construction impacts, as appropriate

- work closely with property owners and other individuals who will be directly affected by the project

GLOSSARY

ACSR	-	Aluminum Conductor Steel Reinforced
agriculture capability	-	A measurement of the range of crops the land is capable of growing where Class 1 support the widest range and Class 7 the narrowest range.
biogeoclimatic zone	-	a classification system which defines areas of British Columbia in terms of climatically distinct zones named after dominant tree species and differentiated by distinct patterns of vegetation and soil
dB and dBA	-	decibels and decibels, A scale; units of measurement of electronic and audible signal and noise levels.
forestry capability	-	A measurement of commercial tree growth subdivided into seven classes where Class 1 represents the highest value and Class 7 the lowest. Units of measurement are volume per unit area per year, e.g. m^3/ha/a (cubic metres per hectare per annum).
geotextile	-	a fabric matting used to reduce effects of erosion or to provide a stable work base in unstable soil conditions
kV	-	kilovolt (one thousand volts), i.e. 500 kV is 500,000 volts.
MW	-	megawatt (one million watts); a watt is the unit for measuring electrical power or the rate of generating, transmitting or consuming electricity.
mass wasting	-	the dislodgement and downslope movement of loose rock and soil material under gravitational influence
riparian	-	Land or animal habitat located on the band of a natural watercourse of a lake.
ROW	-	right-of-way

scree	-	a sloping mass of stones and rock fragments at the foot of a cliff or steep rock face
series compensation	-	Capacitor bands inserted in the line to reduce the line's effective opposition to the flow of electricity. This increases the line's electricity transfer capability.
ungulate	-	Hoofed mammals such as moose and deer.
UREP	-	Land designated by the Ministry of Crown Lands for recreational purposes; abbreviation of "Use, Recreation and Enjoyment by the Public".
viewshed	-	The area or space capable of being seen from a specific standpoint.

REFERENCES

1. Kelly Lake to Cheekye Substation Second 500 kV Transmission Line, Project Justification, B.C. Hydro, March 1991.

2. Kelly Lake to Cheekye Substation Second 500 kV Transmission Line, Technical Report, B.C. Hydro, March 1991.

3. Kelly Lake Substation to Cheekye Substation Second 500 kV Transmission Line, Environmental Impact Assessment Report, Volume One, Analysis, B.C. Hydro, March 1991.

4. Kelly Lake to Cheekye Substation Second 500 kV Transmission Line, Environmental Impact Assessment Report, Volume Two, Atlas, B.C. Hydro, March 1991.

5. Kelly Lake to Cheekye Substation Second 500 kV Transmission Line, Public Consultation Report Phases 1 & 2, Synergistics Consulting Ltd., April 1991 (complete with Appendices - Volume 1 and Appendices - Volume 2).

6. Kelly Lake to Cheekye Substation Second 500 kV Transmission Line, Public Consultation Report Phases 1 & 2, Addendum, Phase 3, Synergistics Consulting Ltd., April 1991.

The following reports will be submitted at a later date:

1. Kelly Lake to Cheekye Substation Second 500 kV Transmission Line, Consultation with Native Bands, B.C. Hydro.

2. Kelly Lake to Cheekye Substation Second 500 kV Transmission Line, Response Document and Summary of Commitments, B.C. Hydro.

TABLE 1

AGGREGATE NET PRESENT VALUE (NPV)

	At 6% Discount Rate		At 8% Discount Rate (base case)		At 10% Discount Rate	
	$ Million		$ Million		$ Million	
	Sequence 1	Sequence 2	Sequence 1	Sequence 2	Sequence 1	Sequence 2
Present Value, Aggregate Annual Costs*	$412	$356	$349	$287	$305	$238
Transmission Loss Savings	$421	$333	$280	$209	$194	$136
Total Aggregate NPV, net of losses	-$9	$23	$69	$78	$111	$102
Sequence 1 - Sequence 2 Difference	-$32		-$9		+$9	

* Annual costs include charges for interest, depreciation, operating and maintenance and taxes for all projects in the plan

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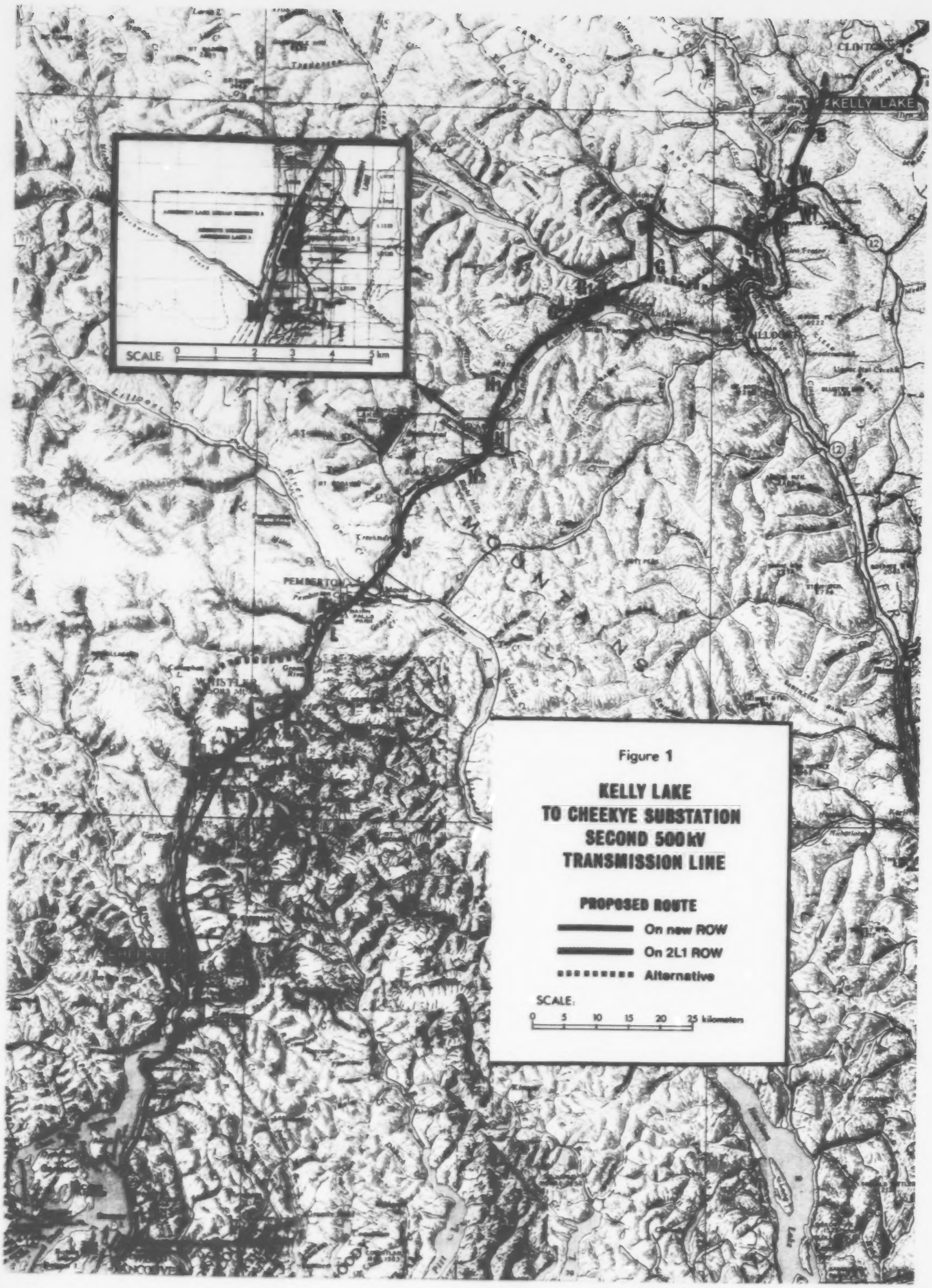
TABLE 2

LONG TERM PAY BACK OF THE KELLY LAKE TO CHEEKYE PROJECT

	Net Present Value		
	At 6% Discount Rate	At 8% Discount Rate (base case)	At 10% Discount Rate
	$ Million	$ Million	$ Million
Present Value, Project Costs*	$150.7	$135.2	$124.3
Transmission Loss Savings	$171.6	$116.1	$ 81.9
Pay Back (over 45 year lifetime)	114%	86%	66%

* Annual costs include charges for interest, depreciation, operation and maintenance and taxes for the Kelly Lake to Cheekye project only


KELLY LAKE
PEMBERTON
SCALE: 0 1 2 3 4 5 km
Figure 1
KELLY LAKE
TO CHEEKYE SUBSTATION
SECOND 500 kV
TRANSMISSION LINE
PROPOSED ROUTE
On new ROW
On 2L1 ROW
Alternative
SCALE:
0 5 10 15 20 25 kilometers

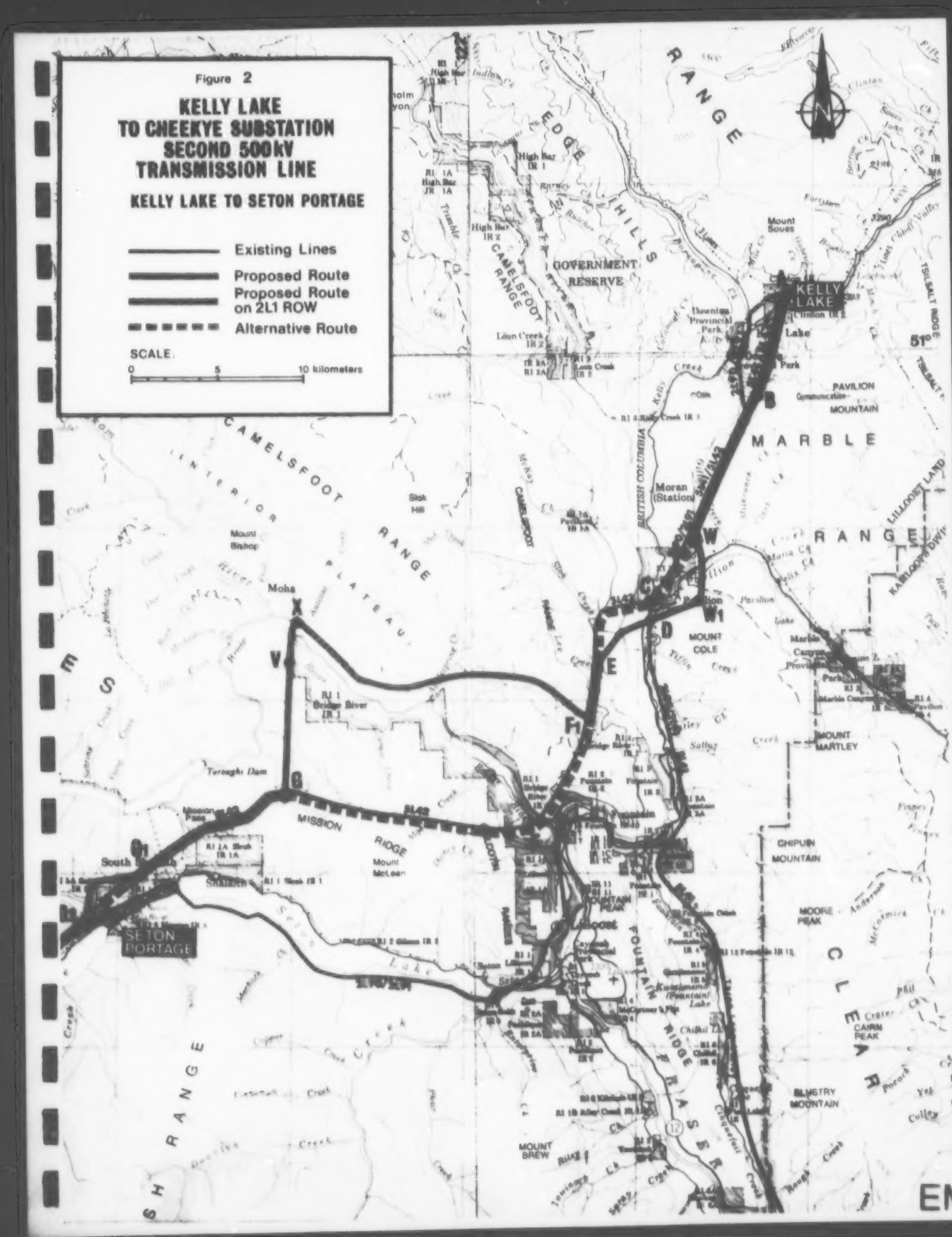


Figure 2
KELLY LAKE
TO CHEEKYE SUBSTATION
SECOND 500kV
TRANSMISSION LINE
KELLY LAKE TO SETON PORTAGE
Existing Lines
Proposed Route
Proposed Route on 2L1 ROW
Alternative Route
SCALE:
0
5
10 kilometers
N
KELLY LAKE
SETON PORTAGE
MARBLE RANGE
CAMELSFOOT RANGE
INTERIOR PLATEAU
COAST MOUNTAINS
CLEARWATER
GOVERNMENT RESERVE
MISSION RIDGE
FRASER
Mount Bishop
Mount Cole
Mount Martley
Chipuin Mountain
Moore Peak
Cairn Peak
Blustry Mountain
Mount Brew
Moran (Station)
Pavilion Mountain
Marble Canyon Provincial Park
Hurley River
Bridge River
Tyaughton Creek
Tyaughton Provincial Park
Mount Soues
Mount McLean
Fountain Peak
Fountain Ridge
Fountain (Pantzilenemi) Lake
Seton Lake
Anderson Lake
Lillooet Land District
Kamloops Div
Tsilsalt Ridge
Lillooet
Pavilion
Bridge River IR 1
High Bar IR 1
High Bar IR 2
Leon Creek IR 2
Slok Hill
Mosha
Terzaghi Dam
Shalalth
South Shalalth
Mission Pass
Lillooet
Lytton
Clinton
Ashcroft
Cache Creek
Kamloops
Williams Lake
Quesnel
Prince George
Vancouver
Seattle
Portland
Spokane
Calgary
Edmonton
Banff
Jasper
Prince Rupert
Whitehorse
Yellowknife
Dawson
Fairbanks
Anchorage
Juneau
Sitka
Ketchikan
Skagway
Haines
Atlin
Dease Lake
Watson Lake
Fort Nelson
Fort St. John
Dawson Creek
Grande Prairie
Peace River
Fort McMurray
Edmonton
Calgary
Lethbridge
Medicine Hat
Regina
Saskatoon
Prince Albert
Winnipeg
Thunder Bay
Sault Ste. Marie
Sudbury
Timmins
Kapuskasing
Hearst
Moosonee
Cochrane
Kirkland Lake
North Bay
Ottawa
Montreal
Quebec City
Fredericton
Saint John
Moncton
Halifax
Sydney
Charlottetown
Yarmouth
Truro
New Glasgow
Antigonish
Pictou
Amherst
Sackville
Dorchester
Shediac
Bathurst
Campbellton
Edmundston
Woodstock
Grand Falls
Perth-Andover
Plaster Rock
Doaktown
Boiestown
Blackville
Newcastle
Chatham
Miramichi
Fredericton Junction
Oromocto
Gagetown
Minto
Chipman
Salisbury
Petitcodiac
Hillsborough
Riverview
Dieppe
Shediac
Cape Tormentine
Port Elgin
Sackville
Amherst
Tidnish
Pugwash
Wallace
Tatamagouche
Malagash
Pictou
New Glasgow
Stellarton
Trenton
Westville
Pictou
Antigonish
Guysborough
Port Hawkesbury
Canso
Mulgrave
Sherbrooke
Liscomb
Country Harbour
Tangier
Musquodoboit Harbour
Jeddore
Lawrencetown
Cole Harbour
Dartmouth
Halifax
Bedford
Sackville
Fall River
Waverley
Windsor
Hantsport
Kentville
Wolfville
Canning
Port Williams
Coldbrook
Greenwich
Kingsport
Canning
Port Williams
Coldbrook
Greenwich
Kingsport
Canning
Port Williams
Coldbrook
Greenwich
Kingsport

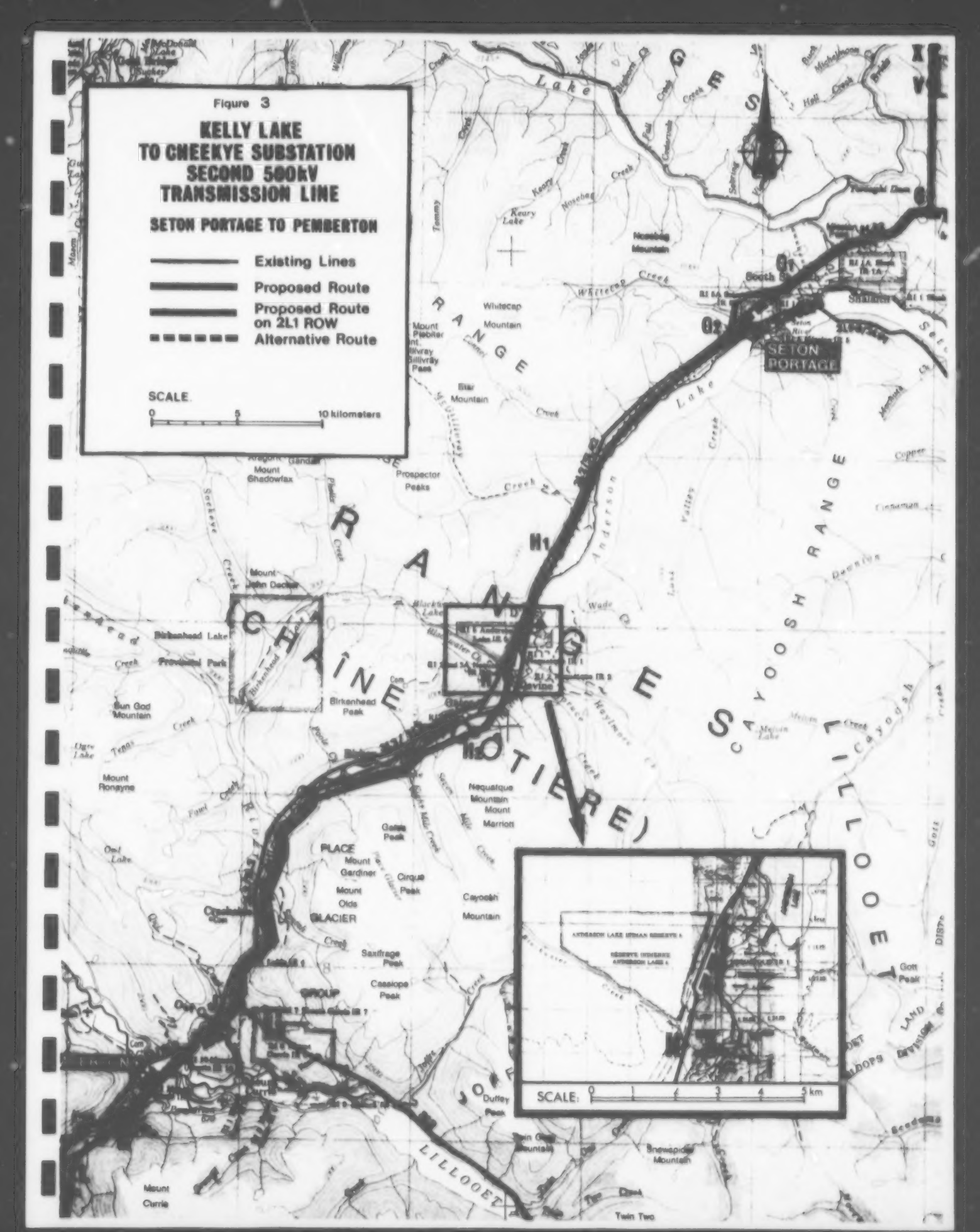
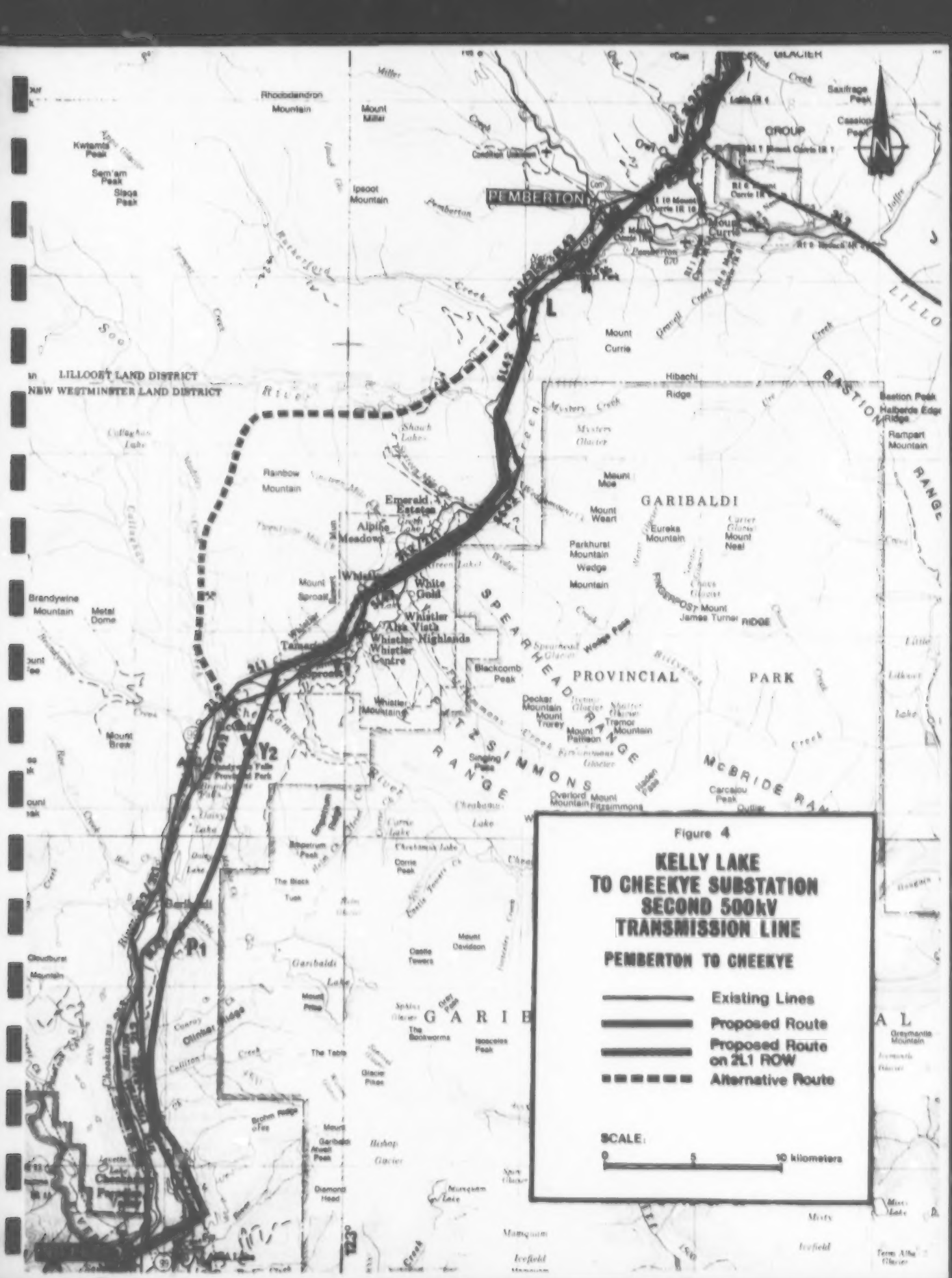
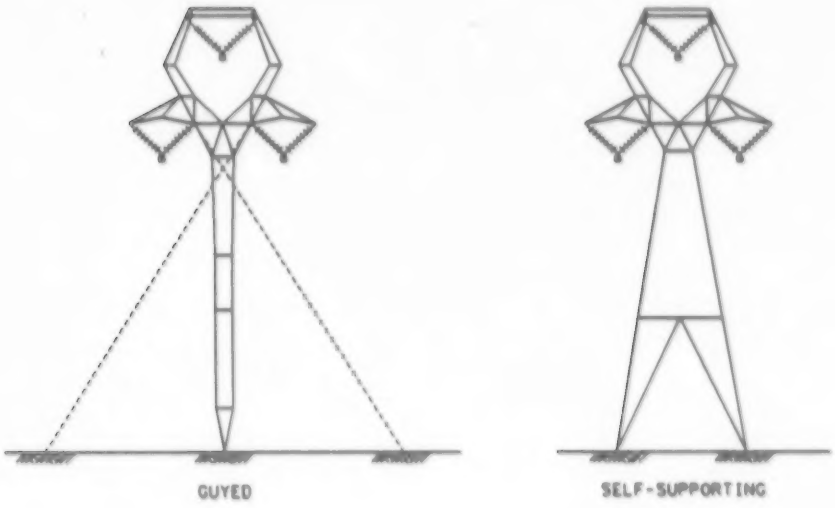


Figure 3
KELLY LAKE
TO CHEEKYE SUBSTATION
SECOND 500kV
TRANSMISSION LINE
SETON PORTAGE TO PEMBERTON
Existing Lines
Proposed Route
Proposed Route on 2L1 ROW
Alternative Route
SCALE
0
5
10 kilometers
SETON PORTAGE
Lillooet Lake
Keary Lake
Whitecap Mountain
Mount Fletcher
Bear Mountain
Prospector Peaks
Mount Shadowfax
Mount John Decker
Birkenhead Lake
Provincial Park
Birkenhead Peak
Sun God Mountain
Mount Ronayne
Nequatque Mountain
Mount Marriott
Gates Peak
PLACE
Mount Gardiner
Cirque Peak
Mount Olds
GLACIER
Cayoosh Mountain
Saxifrage Peak
Cassiope Peak
GROUP
Duffey Peak
Mount Currie
Twin Two
Snowspider Mountain
Gott Peak
SCALE: 0 1 2 3 4 5 km
CHAINE
RANGE
LILLOOET
CAYOOSH RANGE

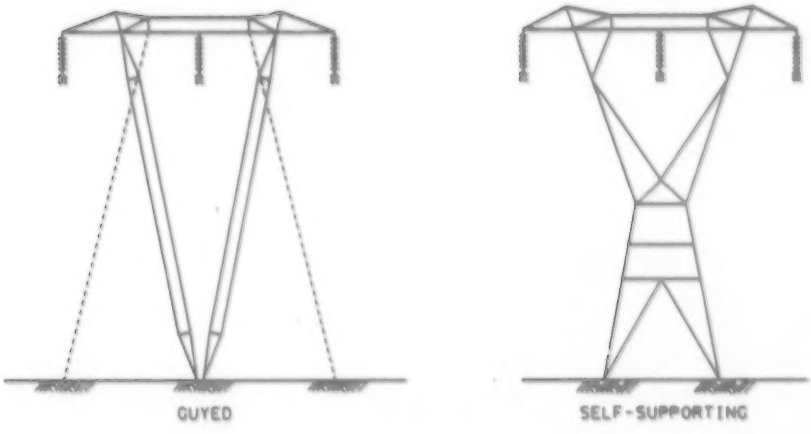

LILLOOET LAND DISTRICT
NEW WESTMINSTER LAND DISTRICT
PEMBERTON
GARIBALDI
PROVINCIAL
PARK
SPEARHEAD RANGE
TRSIMMONS
RANGE
McBRIDE RAN
Mount Currie
Hibachi Ridge
Rainbow Mountain
Alpine Meadows
Emerald Estates
Whistler
White Gold
Whistler Alta Vista
Whistler Highlands
Whistler Centre
Blackcomb Peak
Whistler Mountain
Mount Sproatt
Mount Brew
Brandywine Mountain
Metal Dome
Cloudburst Mountain
Mount Price
Mount Garibaldi
Diamond Head
Mount Davidson
Castle Towers
Mount Weart
Mount Moe
Eureka Mountain
Parkhurst Mountain
Wedge Mountain
Mount James Turner
Mount Neal
Decker Mountain
Mount Trorey
Mount Patterson
Tremor Mountain
Overlord Mountain
Mount Fitzsimmons
Singing Pass
Wedge Pass
Rhododendron Mountain
Mount Miller
Ipsoot Mountain
Kwetama Peak
Sem'am Peak
Slaga Peak
Saxifrage Peak
Cassiope Peak
Section Peak
Halberde Edge Ridge
Rampart Mountain
Greymantle Mountain
Carcajou Peak
Y1
Y2
P1
2L1
2L2
2L3
Figure 4
KELLY LAKE
TO CHEEKYE SUBSTATION
SECOND 500kV
TRANSMISSION LINE
PEMBERTON TO CHEEKYE
Existing Lines
Proposed Route
Proposed Route on 2L1 ROW
Alternative Route
SCALE:
0
5
10 kilometers

Kelly Lake to Cheekye Substation
Second 500 kV Transmission Line

Figure 5
Outline of Structure Types



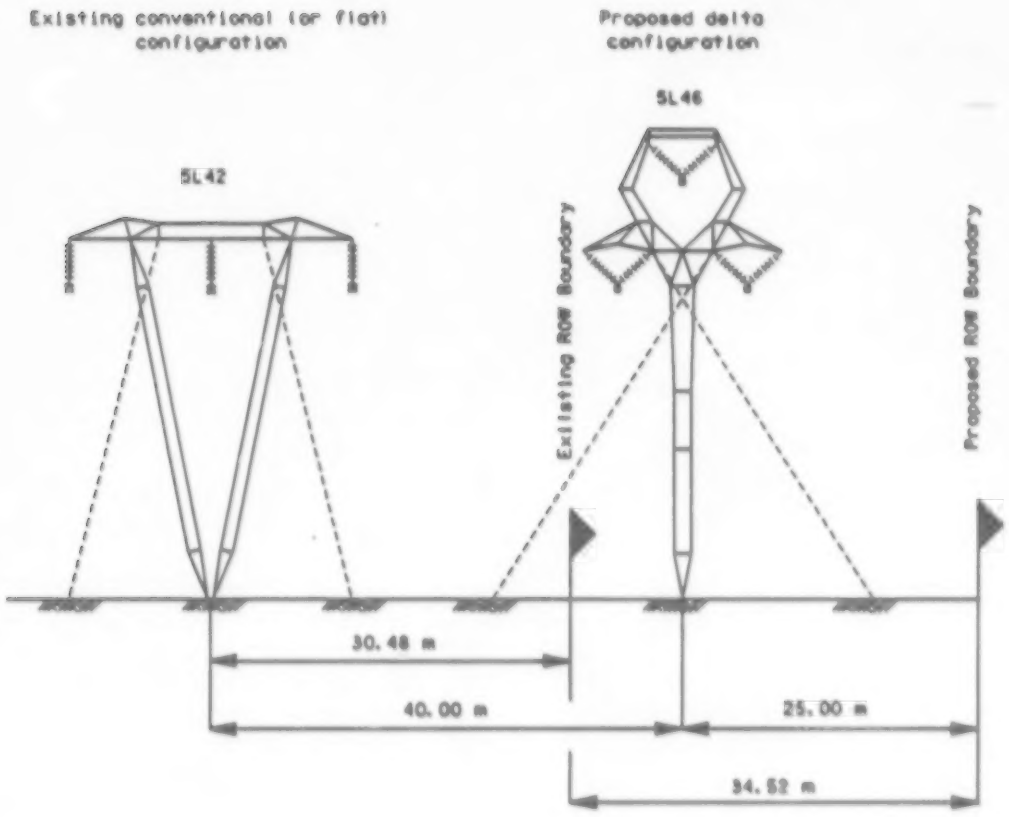
a) Typical Delta Configuration



b) Typical Conventional (or Flat) Configuration

Kelly Lake to Cheekye Substation
Second 500 kV Transmission Line

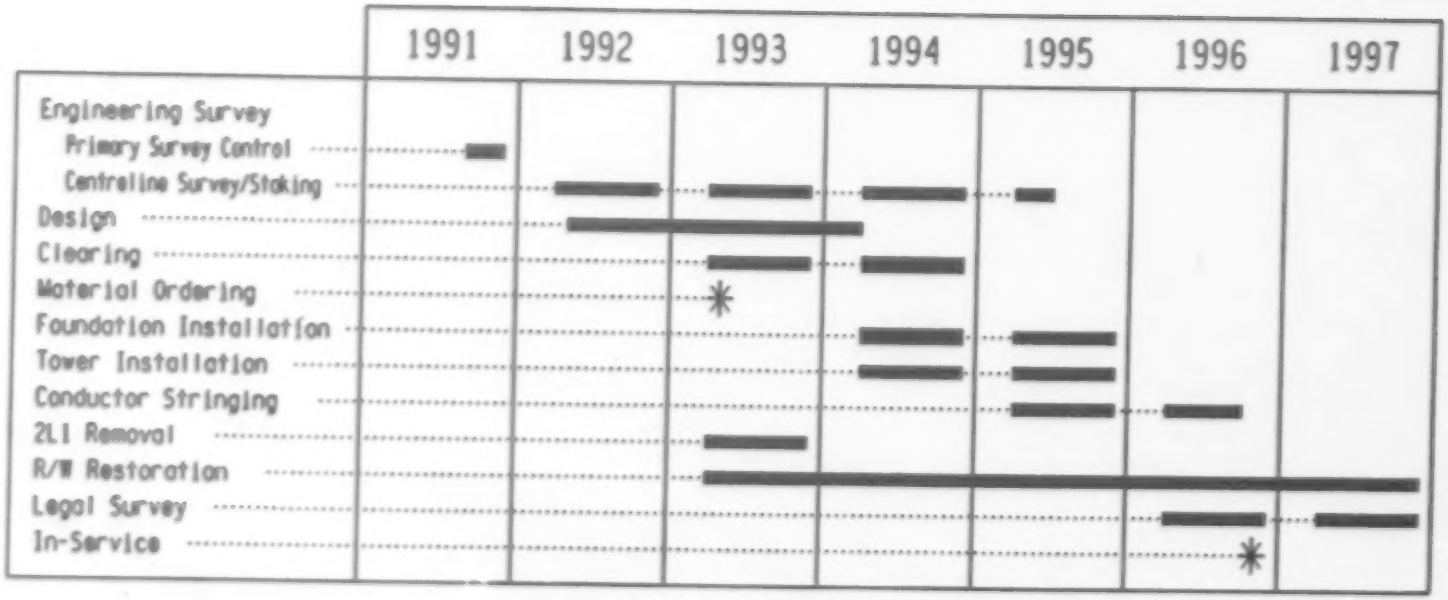
Figure 6
Typical Right-of-Way Requirements



Note: This figure shows a cross-section which depicts typical right-of-way requirements for a proposed 500 kV delta type tower located adjacent to an existing conventional (or flat) type tower

Kelly Lake to Cheekye Substation
Second 500 kV Transmission Line

Figure 7
Proposed Project Schedule



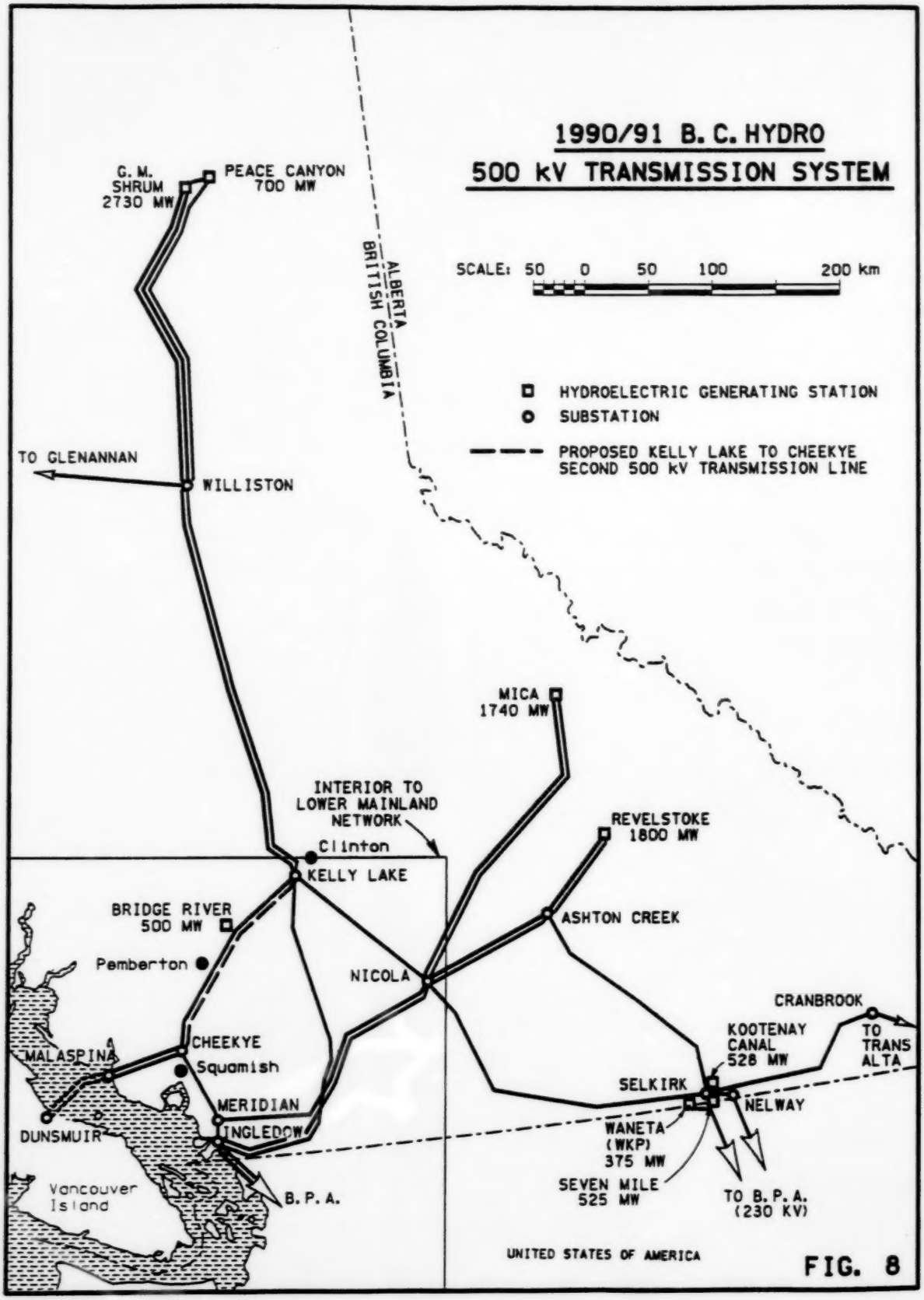

1990/91 B. C. HYDRO
500 kV TRANSMISSION SYSTEM
SCALE: 50 0 50 100 200 km
HYDROELECTRIC GENERATING STATION
SUBSTATION
PROPOSED KELLY LAKE TO CHEEKYE SECOND 500 kV TRANSMISSION LINE
G. M. SHRUM 2730 MW
PEACE CANYON 700 MW
ALBERTA
BRITISH COLUMBIA
TO GLENANNAN
WILLISTON
MICA 1740 MW
INTERIOR TO LOWER MAINLAND NETWORK
REVELSTOKE 1800 MW
Clinton
KELLY LAKE
BRIDGE RIVER 500 MW
ASHTON CREEK
Pemberton
NICOLA
CRANBROOK
KOOTENAY CANAL 528 MW
TO TRANS ALTA
MALASPINA
CHEEKYE
Squamish
SELKIRK
NELWAY
MERIDIAN
DUNSMUIR
INGLEDOW
WANETA (WKP) 375 MW
SEVEN MILE 525 MW
TO B. P. A. (230 KV)
Vancouver Island
B. P. A.
UNITED STATES OF AMERICA

FIG. 8